SOIL SURVEY

Hunterdon County New Jersey

UNITED STATES DEPARTMENT OF AGRICULTURE
Soil Conservation Service
In cooperation with
NEW JERSEY AGRICULTURAL EXPERIMENT STATION
Issued November 1974

Major fieldwork for this soil survey was done in the period 1962–67. Soil names and descriptions were approved in 1970. Unless otherwise indicated, statements in the publication refer to conditions in the county in 1970. This survey was made cooperatively by the Soil Conservation Service and the New Jersey Agricultural Experiment Station at Rutgers, the State University, Cook College. It is part of the technical assistance furnished to the Hunterdon County Soil Conservation District.

Either enlarged or reduced copies of the soil map in this publication can be made by commercial photographers, or they can be purchased on individual order from the Cartographic Division, Soil Conservation Service, United States Department of Agriculture, Washington, D.C. 20250.

HOW TO USE THIS SOIL SURVEY

THIS SOIL SURVEY contains information that can be applied in managing farms and woodlands; in selecting sites for roads, ponds, buildings, and other structures; and in judging the suitability of tracts of land for agriculture, industry, and recreation.

Locating Soils

All the soils of Hunterdon County are shown on the detailed map at the back of this publication. This map consists of many sheets made from aerial photographs. Each sheet is numbered to correspond with a number on the Index to Map Sheets.

On each sheet of the detailed map, soil areas are outlined and are identified by symbols. All areas marked with the same symbol are the same kind of soil. The soil symbol is inside the area if there is enough room; otherwise, it is outside and a pointer shows where the symbol belongs.

Finding and Using Information

The "Guide to Mapping Units" can be used to find information. This guide lists all the soils of the county in alphabetic order by map symbol and gives the capability classification of each. It also shows the page where each soil is described and the page for the woodland group in which the soil has been placed.

Individual colored maps showing the relative suitability or degree of limitation of soils for many specific purposes can be developed by using the soil map and the information in the text. Translucent material can be used as an overlay over the soil map and colored to show soils that have the same limitation or suitability. For example, soils that have a slight limitation for a given use can be colored green, those with a moderate limitation can be colored yellow, and those with a severe limitation can be colored red.

Farmers and those who work with farmers can learn about use and management of the soils in the soil descriptions and from the discussions of the capability units and other groupings.

Foresters and others can refer to the section "Woodland," where the soils of the county are grouped according to their suitability for trees, and management of each group is discussed.

Game managers, sportsmen, and others can find information about soils and wildlife in the section "Wildlife."

Community planners and others can read about soil properties that affect the choice of sites for nonindustrial buildings and for recreation areas in the section "Town and Country Planning."

Engineers and builders can find, under "Engineering Uses of the Soils," tables that contain test data, estimates of soil properties, and information about soil features that affect engineering practices.

Scientists and others can read about how the soils formed and how they are classified in the section "Formation and Classification of the Soils."

Newcomers in Hunterdon County may be especially interested in the section "General Soil Map," where broad patterns of soils are described.

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Contents

	Page
How this survey was made	1
General soil map	2
Highlands and adjacent part of Piedmont Plateau	2
1. Rowland-Birdsboro-Raritan association	3
2. Duffield-Washington association	3
3. Parker-Edneyville-Califon association	3
4. Pattenburg association	3
5. Washington-Berks-Athol association	3
Soils of the Piedmont Plateau	4
6. Norton-Penn-Klinesville association	4
7. Penn-Klinesville-Bucks association	4
8. Chalfont-Croton-Quakertown association	5
9. Hazleton-Quakertown-Lansdale association	5
10. Penn-Bucks-Reaville association	5
11. Lehigh-Chalfont-Lawrenceville association	5
12. Neshaminy-Mount Lucas-Legore association	5
Descriptions of the soils	6
Abbottstown series	8
Alluvial land	9
Annandale series	9
Athol series	10
Bedington series	11
Berks series	12
Birdsboro series	13
Bowmansville series	14
Bucks series	15
Califon series	16
Chalfont series	17
Cokesbury series	18
Croton series	19
Duffield series	20
Edneyville series	21
Hazleton series	23
Klinesville series	24
Lansdale series	24
Lansdowne series	25
Lawrenceville series	26
Legore series	27
Lehigh series	27
Made land	29
Meckesville series	29
Mount Lucas series	29
Neshaminy series	30
Norton series	32
Parker series	33
Pattenburg series	34
Penn series	35
Pope series	36
Quakertown series	37
Raritan series	38
Readington series	39
Reaville series	39
Reaville series, wet variant	40
Riverhead series	41
Rock land, Edneyville material	42
Rough broken land, shale	42
Rowland series	42
Steep stony land, Parker material	43
Turbotville series	43
Washington series	44
Watchung series	45
Use and management of the soils	45
General management for crops and pasture	45
Capability grouping	46
Estimated yields	55
Woodland	59
Wildlife	63
Elements of wildlife habitat	64
Classes of wildlife	64
Engineering uses of the soils	67
Engineering classification systems	67
Engineering test data	68
Soil properties significant in engineering	69
Engineering interpretations	96
Town and country planning	97
Formation and classification of the soils	124
Factors of soil formation	124
Climate	124
Plant and animal life	124
Parent material	124
Topography	124
Time	124
Processes of horizon differentiation	125
Major soil horizons	126
Classification of the soils	126
Additional facts about the county	128
Physiography and relief	128
Climate	128
Literature cited	129
Glossary	129
Guide to mapping units	Following 131

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SOIL SURVEY OF HUNTERDON COUNTY, NEW JERSEY

BY C. F. JABLONSKI, SOIL CONSERVATION SERVICE

SOILS SURVEYED BY K. P. WILSON, C. R. BERDANIER, W. KIRKHAM, J. JOHNSON, AND C. F. JABLONSKI, SOIL CONSERVATION SERVICE

UNITED STATES DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE, IN COOPERATION WITH THE NEW JERSEY AGRICULTURAL EXPERIMENT STATION AT RUTGERS, THE STATE UNIVERSITY, COOK COLLEGE

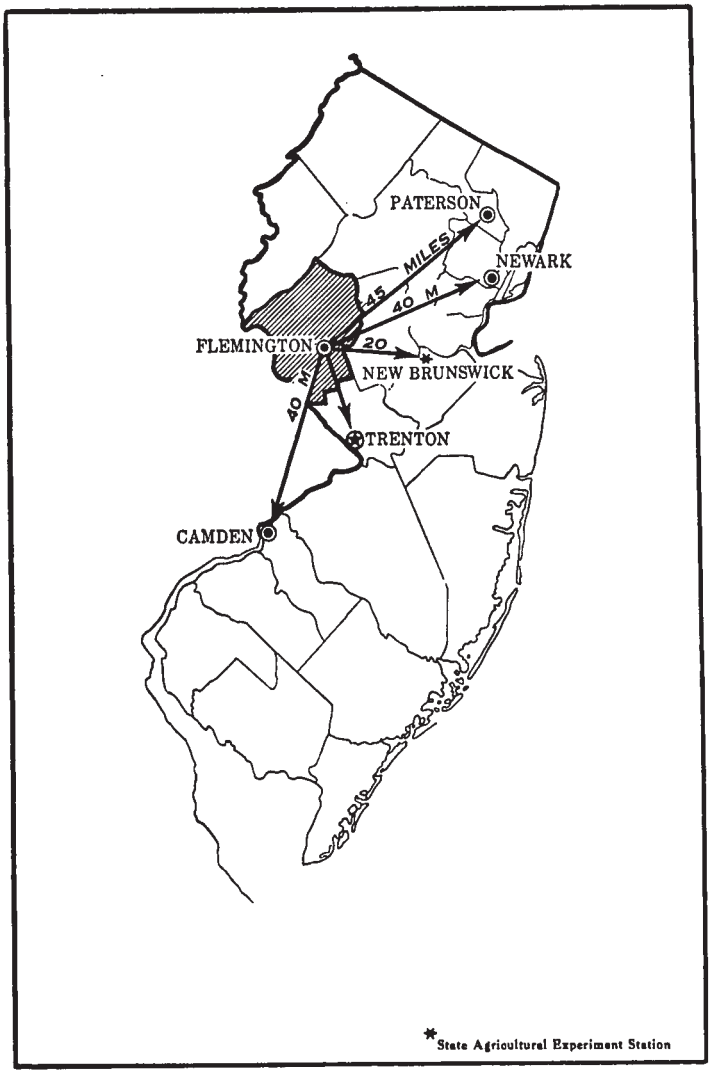

Figure 1.—**Location of Hunterdon County in New Jersey.**

HUNTERDON COUNTY is in the northwestern part of New Jersey (fig. 1). It borders the Delaware River on the west. It has a total of 278,400 acres, 3,600 of which are inland water. The northern third of the county is mostly steep and wooded. The other two thirds consists of gently undulating and moderately sloping plains.

About 85 percent of the county is farms, and about 50 percent of the farmland is cultivated. In 1970 the population was 69,718 for the county and 3,917 for the county seat, Flemington. Though the county borders the Delaware River, more than two thirds of it is drained by the South Branch of the Raritan River, which flows east to the ocean.

Dairying is the dominant type of farming in Hunterdon County. In 1969 about 1,100 farms were in the county. About 35 percent of this total was dairy farms, 15 percent was poultry farms, 10 percent was livestock and horse farms, 10 percent was general farms, and 30 percent was miscellaneous and unclassified farms.

How This Survey Was Made

Soil scientists made this survey to learn what kinds of soil are in Hunterdon County, where they are located, and how they can be used. The soil scientists went into the county knowing they likely would find many soils they had already seen and perhaps some they had not. They observed the steepness, length, and shape of slopes, the size and speed of streams, the kinds of native plants or crops, the kinds of rock, and many facts about the soils. They dug many holes to expose soil profiles. A profile is the sequence of natural layers, or horizons, in a soil; it extends from the surface down into the parent material that has not been changed much by leaching or by the action of plant roots.

The soil scientists made comparisons among the profiles they studied, and they compared these profiles with those in countries nearby and in places more distant. They classified and named the soils according to nationwide, uniform procedures. The *soil series* and the *soil phase* are the categories of soil classification most used in a local survey.

Soils that have profiles almost alike make up a soil series. Except for different texture in the surface layer, all the soils of one series have major horizons that are similar in thickness, arrangement, and other important characteristics. Each soil series is named for a town or

other geographic feature near the place where a soil of that series was first observed and mapped. Pattenburg and Quakertown, for example, are the names of two soil series. All the soils in the United States having the same series name are essentially alike in those characteristics that affect their behavior in the undisturbed landscape.

Soils of one series can differ in texture of the surface soil and in slope, stoniness, or some other characteristic that affects use of the soils by man. On the basis of such differences, a soil series is divided into phases. The name of a soil phase indicates a feature that affects management. For example, Birdsboro silt loam, 0 to 2 percent slopes, is one of several phases within the Birdsboro series.

After a guide for classifying and naming the soils had been worked out, the soil scientists drew the boundaries of the individual soils on aerial photographs. These photographs show woodlands, buildings, field borders, trees, and other details that help in drawing boundaries accurately. The soil map in the back of this publication was prepared from the aerial photographs.

The areas shown on a soil map are called mapping units. On most maps detailed enough to be useful in planning the management of farms and fields, a mapping unit is nearly equivalent to a soil phase. It is not exactly equivalent, because it is not practical to show on such a map all the small, scattered bits of soil of some other kind that have been seen within an area that is dominantly of a recognized soil phase.

Some mapping units are made up of soils of different series, or of different phases within one series. Two such kinds of mapping units are shown on the soil map of Hunterdon County, soil complexes and undifferentiated groups.

A soil complex consists of areas of two or more soils, so intermingled or so small in size that they cannot be shown separately on the soil map. Each area of a complex contains some of each of the two or more dominant soils, and the pattern and relative proportions are about the same in all areas. The name of a soil complex consists of the names of the dominant soils, joined by a hyphen. Chalfont-Quakertown silt loams, 0 to 6 percent slopes, is an example.

An undifferentiated group is made up of two or more soils that could be delineated individually but are shown as one unit because, for the purpose of the soil survey, there is little value in separating them. The pattern and proportion of soils are not uniform. An area shown on the map may be made up of only one of the dominant soils, or of two or more. The name of an undifferentiated group consists of the names of the dominant soils, joined by "and." Annandale and Edneyville gravelly loams, 8 to 15 percent slopes, is an example.

In most areas surveyed there are places where the soil material is so rocky, so shallow, or so severely eroded that it cannot be classified by soil series. These places are shown on the soil map and are described in the survey, but they are called land types and are given descriptive names. Rough broken land, shale, is a land type in Hunterdon County.

While a soil survey is in progress, samples of soils are taken, as needed, for laboratory measurements and for engineering tests. Laboratory data from the same kinds of soil in other places are assembled. Data on yields of crops under defined practices are assembled from farm records and from field or plot experiments on the same kinds of soil. Yields under defined management are estimated for all the soils.

But only part of a soil survey is done when the soils have been named, described, and delineated on the map, and the laboratory data and yield data have been assembled. The mass of detailed information then needs to be organized in such a way as to be readily useful to different groups of users, among them farmers, managers of woodland and rangeland, and engineers.

On the basis of yield and practice tables and other data, the soil scientists set up trial groups. They test these groups by further study and by consultation with farmers, agronomists, engineers, and others, then adjust the groups according to the results of their studies and consultation. Thus, the groups that are finally evolved reflect up-to-date knowledge of the soils and their behavior under present methods of use and management.

General Soil Map

The general soil map at the back of this survey shows, in color, the soil associations in Hunterdon County. A soil association is a landscape that has a distinctive proportional pattern of soils. It normally consists of one or more major soils and at least one minor soil, and it is named for the major soils. The soils in one association may occur in another, but in a different pattern.

A map showing soil associations is useful to people who want a general idea of the soils in a county, who want to compare different parts of a county, or who want to know the location of large tracts that are suitable for a certain kind of land use. Such a map is a useful general guide in managing a watershed, a wooded tract, or a wildlife area, or in planning engineering works, recreational facilities, and community developments. It is not a suitable map for planning the management of a farm or field, or for selecting the exact location of a road, building, or similar structure, because the soils in any one association ordinarily differ in slope, depth, stoniness, drainage, and other characteristics that affect their management.

The 12 soil associations in Hunterdon County are discussed in the following pages. Five of the associations are on the Highlands and the adjacent Piedmont Plateau, and seven are entirely on the Piedmont Plateau.

Highlands and Adjacent Part of Piedmont Plateau

On the Highlands are deep, mostly well drained, moderately sloping to steep, stony, rocky, or gravelly soils. On the adjacent part of the Plateau, the soils are mostly deep, gently sloping to moderately steep, gravelly, stony, or rocky. Included are narrow areas of flood plains. Soils of the Highlands formed over gigantic gneiss; those on the Piedmont Plateau formed over shale, limestone, or glacial till. Much of the Highlands is woodland. Most of the Piedmont Plateau area of the county is used for the production of general crops.

1. Rowland-Birdsboro-Raritan association

Deep, nearly level to gently sloping, well-drained to somewhat poorly drained, nonstony soils; on flood plains and terraces

This association makes up about 5 percent of the county. It is about 40 percent Rowland soils, 15 percent Birdsboro soils, 15 percent Raritan soils, and 30 percent minor soils.

Rowland soils are on flood plains and usually are flooded several times a year. They have a surface layer of silt loam and are moderately well drained to somewhat poorly drained.

Birdsboro soils are on terraces above the level of most floods. They have a surface layer of silt loam and are well drained.

Raritan soils are on terraces above the level of most floods, but they are only moderately well drained to somewhat poorly drained. Some areas are in slight depressions. The surface layer is silt loam.

Pope soils, Bowmansville soils, Alluvial land, loamy, and Alluvial land, loamy, wet, are among the minor components. Pope soils are on terraces above the level of most floods; the others are on flood plains.

The soils on flood plains have severe limitations for housing and related uses because of the frequent floods. Most areas of the soils on terraces have only slight limitations for such uses.

2. Duffield-Washington association

Deep, gently sloping to moderately steep, well-drained soils; some rocky areas; on uplands

This association makes up about 1 percent of the county. It is about 75 percent Duffield soils, 15 percent Washington soils, and 10 percent minor soils.

Duffield soils are dominantly gently sloping to moderately steep. They formed over limestone bedrock, which is cavernous in places. They have a surface layer of mostly silt loam. Where the slope is more than 6 percent, the soils are rocky.

Washington soils are gently sloping to moderately steep. They formed over limestone bedrock, which is cavernous in places.

The minor soils are Turbotville soils and Alluvial land. Turbotville soils are somewhat poorly drained and have a perched water table. The Alluvial land is subject to stream overflow.

In about 80 percent of the areas, the soils in this association are gently sloping or moderately steep and well suited to farming. Some high-value vegetables are grown. Areas of steeper soils are rocky or very rocky. They are used for hay or pasture.

3. Parker-Edneyville-Califon association

Deep, gently sloping to steep, excessively drained to somewhat poorly drained, dominantly gravelly, cobbly, or stony soils; on uplands

This is the most extensive of the associations. It makes up about 25 percent of the county. It is about 40 percent Parker soils, 40 percent Edneyville soils, 10 percent Califon soils, and 10 percent minor soils. The terrain is more rugged than that of most of the county (fig. 2). The range in elevation is 200 to 1,000 feet.

Parker soils are gently sloping to steep, excessively drained, and are cobbly or stony. In areas of gently sloping Parker soils, the stones have been removed to make farming operations easier.

Edneyville soils are mostly gently sloping or moderately steep and are gravelly or extremely stony. Gravelly soils are generally sloping or moderately steep, but in places they are steep. Edneyville soils are well drained.

Califon soils are dominantly nearly level to gently sloping. They are moderately well drained to somewhat poorly drained and have a root-restricting fragipan in the subsoil.

The minor soils are Annandale, Cokesbury, and Alluvial land, loamy. Annandale soils are well drained, and Cokesbury soils are poorly drained. Alluvial land, loamy, is subject to stream overflow.

Less than half of this association is farmed, and over half of it is woodland. The soils are only moderately suited to farming because of steepness and the presence of stones, cobblestones, and gravel. As a result, much of the farmland is reverting to trees, and in places it is being used for residential, commercial, or industrial sites. Ground water as a source of well water is limited and in places controls the size of lots for residences.

4. Pattenburg association

Deep, gently sloping to very steep, well-drained, gravelly soils; on uplands

This association makes up 7 percent of the county. It is about 70 percent Pattenburg soils and 30 percent minor soils. It occurs immediately south of the Highlands.

Most Pattenburg soils are gently sloping or strongly sloping, but in about 20 percent of the areas slope is moderately steep or steep. The surface layer is gravelly loam.

The minor soils are Bucks, Penn, Abbottstown, and Reaville and other soils ranging from well drained to poorly drained and from deep to moderately deep.

Most areas in this association are farmed, especially areas of less sloping soils. The steeper soils are wooded. Limitations for residential development are the steepness of slope and in places wetness.

5. Washington-Berks-Athol association

Deep and moderately deep, gently sloping to moderately steep, well-drained soils; on uplands

This association makes up 2 percent of the county. It is about 30 percent Washington soils, 30 percent Berks soils, 20 percent Athol soils, and 20 percent minor soils. It occurs in several areas south of the Highlands between areas of dominantly Pattenburg soils. Most of the soils are gently sloping or strongly sloping.

Washington soils are mainly gently sloping and have a surface layer of loam. They are deep and formed over limestone that is cavernous in places.

Berks soils are dominantly sloping or strongly sloping. Depth to shale bedrock is moderate.

Athol soils are dominantly gently sloping to strongly sloping. They are deep, well drained, and have a surface layer of gravelly loam.

The minor soils are in the Turbotville, Meckesville, Annandale, and Bedington series and Alluvial land. Turbotville soils are somewhat poorly drained; Meckesville,

Figure 2.—Typical area in association 3. Steep Parker soils in wooded area in background; Edneyville and Califon soils in cultivated fields.

Annandale, and Bedington soils are well drained. The Alluvial land is subject to stream overflow.

Most of the soils are farmed. Washington and Athol soils are well suited to crops. Berks soils are only moderately well suited to crops because of their moderate depth to bedrock.

Primary limitations for community development for Washington and Athol soils are the cavernous properties of the underlying bedrock. Berks soils have shale bedrock at depths between 20 and 40 inches, which limits onsite septic systems severely. Ground water is limited, and in places it is the controlling factor in determining the size of lots.

Soils of the Piedmont Plateau

The dominant soils of the Piedmont Plateau are moderately deep or deep over shale, sandstone, or argillite. Slopes are mostly gently rolling. Most of the soils are well drained but some range to poorly drained. Minor areas are underlain by diabase rock. These areas are very stony.

Most of the acreage is used for dairy farms. Wooded areas are mostly confined to moderately steep, very stony, or poorly drained soils.

6. Norton-Penn-Klinesville association

Deep to shallow, gently sloping to moderately steep, well-drained soils

This association makes up about 6 percent of the county south of the Highlands where glacial till is extensive. It is 30 percent Norton soils, 30 percent Penn soils, 20 percent Klinesville soils, and 20 percent minor soils. The soils are mostly gently sloping to moderately steep.

Norton soils are deep and have slowly permeable, firm, clayey subsoils; and slopes are gently sloping to moderately steep. They have a surface layer of loam.

Penn soils are moderately deep, moderately to moderately rapidly permeable, and gently sloping to moderately steep. They have a surface layer of shaly silt loam.

Klinesville soils are gently sloping to moderately steep and are shallow to bedrock. They have a surface layer of shaly loam.

The minor soils are in the Bucks, Lansdowne, Readington, Reaville, and Abbottstown series. Bucks soils are well drained; all the others are less well drained.

Most areas are farmed, but extensive areas are idle or reverting to trees. The major soils in this association have limitations for community development. Norton soils are slowly permeable. Penn and Klinesville soils have shale bedrock at moderately deep and shallow depths, respectively. Some Penn and Klinesville soils have slope limitations also. Ground water is so limited in places that it controls the determination of lot size in those places.

7. Penn-Klinesville-Bucks association

Shallow to deep, gently sloping to moderately steep, well-drained soils

This association makes up about 6 percent of the county. It is about 30 percent Penn soils, 30 percent Klinesville

soils, 15 percent Bucks soils, and 25 percent minor soils. Slopes are dominantly gently sloping to strongly sloping, but areas of moderately steep and steep soils are present.

Penn soils are moderately deep and shaly.

Klinesville soils are shallow and gently sloping to moderately steep. These soils are moderately steep in many areas. They have a surface layer of shaly loam.

Bucks soils are deep and gently sloping to strongly sloping. They have a surface layer of silt loam.

The minor soils include Abbottstown, Readington, and Reaville soils. All have drainage impediments.

Most of the soils are farmed, but Klinesville soils are mostly in trees. Depth to bedrock is a major limitation to the use of these soils for community development.

8. *Chalfont-Croton-Quakertown association*

Deep, nearly level to strongly sloping, poorly drained to well-drained soils

This association makes up about 13 percent of the county. It is 60 percent Chalfont soils, 15 percent Croton soils, 10 percent Quakertown soils, and 15 percent minor soils. Most slopes are nearly level to strongly sloping. Surface textures are dominantly silt loam or very stony silt loam.

Chalfont soils are nearly level or sloping, somewhat poorly drained, and have a slowly permeable fragipan.

Croton soils are gently sloping, poorly drained, and have a fragipan in the subsoil that is slowly permeable.

Quakertown soils are nearly level to strongly sloping and are well drained.

The minor soils are in the Hazleton and Lansdale series. They are well drained.

Poor drainage is the principle limitation in this association. Excessive wetness limits the usefulness of Chalfont and Croton soils for farming and other uses. The establishment of proper drainage is very helpful in improving the usefulness of these soils.

9. *Hazleton-Quakertown-Lansdale association*

Deep, gently sloping to very steep, well-drained, dominantly channery soils

This association makes up about 9 percent of the county. It is about 45 percent Hazleton soils, 20 percent Quakertown soils, 15 percent Lansdale soils, and 20 percent minor soils. The area occupies mostly high positions in the landscape. Over half of the soils are gently sloping to strongly sloping. More than 10 percent of the association is sloping to very steep, very stony soils.

Hazleton soils are gently sloping to very steep. They contain many sandstone fragments, called "channers," that normally increase in amount with depth of soil.

Quakertown soils are predominantly gently sloping to strongly sloping. They have a surface layer of silt loam.

Lansdale soils are nearly level to moderately steep. They have a surface layer of loam.

The minor soils are in the Chalfont, Readington, and Reaville series. These soils are excessively wet in winter and early in spring.

Most of the less sloping soils are farmed. Ground water is generally adequate for wells for residences. The depth to bedrock is a limitation for the installation of onsite septic tank systems.

10. *Penn-Bucks-Reaville association*

Moderately deep and deep, gently sloping to moderately steep, well-drained to somewhat poorly drained soils.

This association (fig. 3) makes up about 20 percent of the county. It is 50 percent Penn soils, 15 percent Bucks soils, 10 percent Reaville soils, and 25 percent minor soils.

Penn soils are gently sloping to moderately steep. They are shaly and moderately deep to red shale bedrock. These soils are well drained.

Bucks soils are gently sloping to strongly sloping, are deep to bedrock, and have a silt loam surface layer.

Reaville soils are nearly level or gently sloping. They are moderately deep and are moderately well drained to somewhat poorly drained.

The minor soils are in the Abbottstown, Klinesville, and Readington series.

Most of the soils of this association are farmed. The moderately steep soils are mostly in pasture or trees.

Depth to bedrock is an important limitation for Penn and Bucks soils where deep excavations are needed. Reaville soils are only moderately deep and are excessively wet in winter and in spring. In places ground water is inadequate. This places a limit on the size of lots for residential developments.

11. *Lehigh-Chalfont-Lawrenceville association*

Deep, nearly level to moderately steep, moderately well drained and somewhat poorly drained, nonstony to very stony soils

This association makes up about 2 percent of the county. It is about 50 percent Lehigh soils, 30 percent Chalfont soils, 10 percent Lawrenceville soils, and 10 percent minor soils.

Lehigh soils mostly range from gently sloping to moderately steep. In about 10 percent of the acreage, they are moderately steep. These soils are moderately well drained and somewhat poorly drained. Some areas are very stony.

Chalfont soils range in slope from nearly level to moderately steep, but are mostly gently sloping to strongly sloping. These soils are deep, silty, and somewhat poorly drained. They are slowly permeable. Some areas are very stony.

Lawrenceville soils are gently sloping to strongly sloping. They are deep and moderately well drained. Their surface layer is silt loam.

The minor soils are in the Quakertown and Croton series. Quakertown soils are well drained, and Croton soils are poorly drained.

Most areas of nearly level and gently sloping soils are farmed. The moderately steep soils are mostly in pasture or trees. Excess water is in all the major soils in winter and early in spring. Drainage is difficult because permeability of the major soils is slow.

12. *Neshaminy-Mount Lucas-Legore association*

Deep, nearly level to very steep, well-drained to somewhat poorly drained, mostly very stony soils

This association makes up about 4 percent of the county. It is 70 percent Neshaminy soils, 10 percent Mount Lucas soils, 10 percent Legore soils, and 10 percent minor soils. The largest areas occur as ridges of the Sourland, Cushetunk, and Round Mountains which are about 200 feet above

Figure 3.—**Typical area in association 10. Gently sloping Penn soils in foreground; nearly level Bucks soils in cultivated fields; Reaville soils at lower elevations.**

the surrounding area. The mountains are diabase or trap-rock dikes.

Neshaminy soils are gently sloping to very steep. Most steep to very steep slopes and some gentle slopes are very stony. In places soils that have lower slopes are silt loam. The Neshaminy soils are well drained.

Mount Lucas soils are nearly level to sloping. They are moderately well drained to somewhat poorly drained. More than half of the Mount Lucas soils are very stony.

Legore soils are gently sloping to moderately steep. They are well drained and gravelly.

The minor soils are in the Lawrenceville, Lehigh, and Watchung series. All have restricted drainage.

Most of the association is very stony and is woodland. In places there are rock outcrops. In some areas stones have been removed to make farming operations easier. Ground water is limited and barely adequate for residential wells. The abundance of stones, steep slopes, rock outcrops, and inadequately drained areas limits the use of most of the soils in this association.

Descriptions of the Soils

This section describes the soil series and mapping units in Hunterdon County. Each soil series is described in considerable detail, and then each mapping unit in that series is described briefly. Unless it is specifically stated otherwise, it is to be assumed that what is stated about the soil series holds true for the mapping units in that series. Thus, to get full information about any one mapping unit, it is necessary to read both the description of the mapping unit and the description of the soil series to which it belongs.

An important part of the description of each soil series is the soil profile, that is, the sequence of layers from the surface downward to rock or other underlying material. Each series contains two descriptions of this profile. The first is brief and in terms familiar to the layman. The second, detailed and in technical terms, is for scientists, engineers, and others who need to make thorough and precise studies of soils. Unless it is otherwise stated, the descriptions refer to moist soils.

As mentioned in the section "How This Survey Was Made," not all mapping units are members of a soil series. Made land, for example, does not belong in a soil series, but nevertheless it is listed in alphabetic order along with the soil series.

Following the name of each mapping unit is a symbol in parentheses. This symbol identifies the mapping unit on the detailed soil map. Listed at the end of the description of each mapping unit are the capability unit and woodland group in which the mapping unit has been placed. The page on which each of these groups is described can be found by referring to the "Guide to Mapping Units" at the back of this publication.

The acreage and proportionate extent of each mapping unit are shown in table 1. Many of the terms used in describing soils can be found in the glossary at the end

of this survey, and more detailed information about the terminology and methods of soil mapping can be obtained from the Soil Survey Manual (*12*).[1]

A given soil series in this county may be identified by a different name in a recently published soil survey of a nearby county. Such differences in name result from changes in the concepts of soil classification that have occurred since publication. The characteristics of the soil series described in this county are considered to be within the range defined for that series. In those instances where a soil has one or more features outside the defined range, the differences are explained.

[1] Italic numbers in parentheses refer to Literature Cited, page 129.

TABLE 1.—*Approximate acreage and proportionate extent of the soils*

Soil	Area	Extent	Soil	Area	Extent
	Acres	*Percent*		*Acres*	*Percent*
Abbottstown silt loam, 0 to 2 percent slopes	1,500	0.5	Edneyville gravelly loam, 8 to 15 percent slopes, eroded	8,050	2.9
Abbottstown silt loam, 2 to 6 percent slopes	4,200	1.5	Edneyville gravelly loam, 15 to 25 percent slopes	1,780	.6
Alluvial land, loamy	2,260	.8	Edneyville and Parker extremely stony loams, 3 to 15 percent slopes	6,350	2.3
Alluvial land, loamy, wet	400	.1	Hazleton channery loam, 2 to 6 percent slopes	2,010	.7
Annandale gravelly loam, 3 to 8 percent slopes	1,900	.7	Hazleton channery loam, 6 to 12 percent slopes, eroded	3,950	1.4
Annandale gravelly loam, 8 to 15 percent slopes, eroded	770	.2	Hazleton channery loam, 12 to 18 percent slopes	1,550	.7
Annandale and Edneyville gravelly loams, 3 to 8 percent slopes	1,620	.6	Hazleton very stony loam, 6 to 18 percent slopes	1,390	.5
Annandale and Edneyville gravelly loams, 8 to 15 percent slopes	1,180	.4	Hazleton very stony loam, 18 to 40 percent slopes	2,300	.8
Athol gravelly loam, 2 to 6 percent slopes	770	.3	Klinesville shaly loam, 4 to 12 percent slopes	6,400	2.3
Athol gravelly loam, 6 to 12 percent slopes, eroded	360	.1	Klinesville shaly loam, 12 to 18 percent slopes	2,420	.9
Athol gravelly loam, 12 to 18 percent slopes, eroded	130	(1)	Lansdale loam 0 to 6 percent slopes	1,860	.7
Bedington shaly silt loam, 2 to 6 percent slopes	230	.1	Lansdale loam, 6 to 12 percent slopes, eroded	1,500	.5
Bedington shaly silt loam, 6 to 12 percent slopes, eroded	130	(1)	Lansdale loam, 12 to 18 percent slopes	340	.1
Berks shaly loam, 2 to 6 percent slopes	340	.1	Lansdowne silt loam, 0 to 6 percent slopes	1,580	.6
Berks shaly loam, 6 to 12 percent slopes, eroded	920	.3	Lawrenceville silt loam, 2 to 6 percent slopes	1,870	.7
Berks shaly loam, 12 to 18 percent slopes, eroded	680	.2	Lawrenceville silt loam, 6 to 12 percent slopes, eroded	330	.1
Birdsboro silt loam, 0 to 2 percent slopes	460	.2	Legore gravelly loam, 2 to 6 percent slopes	250	.1
Birdsboro silt loam, 2 to 6 percent slopes	1,550	.6	Legore gravelly loam, 6 to 12 percent slopes	680	.2
Birdsboro silt loam, 6 to 12 percent slopes, eroded	420	.2	Legore gravelly loam, 12 to 18 percent slopes	370	.1
Bowmansville silt loam	2,000	.7	Lehigh silt loam, 2 to 6 percent slopes	1,440	.5
Bucks silt loam, 2 to 6 percent slopes	8,650	3.1	Lehigh silt loam, 6 to 12 percent slopes, eroded	1,030	.4
Bucks silt loam, 6 to 12 percent slopes, eroded	2,370	.9	Lehigh silt loam, 12 to 18 percent slopes, eroded	320	.1
Califon loam, 0 to 3 percent slopes	250	.1	Lehigh very stony silt loam, 2 to 6 percent slopes	230	.1
Califon loam, 3 to 8 percent slopes	2,670	1.0	Lehigh very stony silt loam, 6 to 18 percent slopes	170	.1
Califon very stony loam, 0 to 8 percent slopes	4,900	1.8	Made land	220	.1
Chalfont silt loam, 0 to 2 percent slopes	6,250	2.3	Meckesville gravelly loam, 2 to 6 percent slopes	550	.2
Chalfont silt loam, 2 to 6 percent slopes	12,200	4.4	Meckesville gravelly loam, 6 to 12 percent slopes, eroded	310	.1
Chalfont silt loam, 6 to 12 percent slopes, eroded	3,800	1.4	Mount Lucas silt loam, 0 to 6 percent slopes	670	.2
Chalfont very stony silt loam, 2 to 12 percent slopes	720	.3	Mount Lucas-Watchung very stony silt loams, 0 to 6 percent slopes	2,500	.9
Chalfont-Lehigh very stony silt loams, 2 to 12 percent slopes	490	.2	Neshaminy gravelly loam, 2 to 6 percent slopes	330	.1
Chalfont-Quakertown silt loams, 0 to 6 percent slopes	870	.3	Neshaminy silt loam, 2 to 6 percent slopes	690	.3
Cokesbury loam	1,300	.5	Neshaminy silt loam, 6 to 12 percent slopes, eroded	520	.2
Cokesbury very stony loam	1,480	.5	Neshaminy very stony silt loam, 2 to 12 percent slopes	490	.2
Croton silt loam, 0 to 2 percent slopes	3,950	1.4	Neshaminy very stony silt loam, 12 to 18 percent slopes	1,560	.6
Croton silt loam, 2 to 6 percent slopes	930	.3	Neshaminy very stony silt loam, 18 to 40 percent slopes	3,150	1.1
Croton very stony silt loam, 0 to 6 percent slopes	720	.3	Neshaminy-Mount Lucas very stony silt loams, 2 to 12 percent slopes	3,350	1.2
Duffield silt loam, 2 to 6 percent slopes	1,240	.5	Norton loam, 2 to 6 percent slopes	3,450	1.2
Duffield silt loam, 6 to 12 percent slopes, eroded	710	.3	Norton loam, 6 to 12 percent slopes, eroded	1,540	.6
Duffield rocky silt loam, 6 to 12 percent slopes, eroded	280	.1	Norton loam, 12 to 18 percent slopes, eroded	250	.1
Duffield very rocky silt loam, 12 to 18 percent slopes, eroded	360	.1			
Edneyville gravelly loam, 3 to 8 percent slopes	400	3.4			

See footnotes at end of table.

TABLE 1.—*Approximate acreage and proportionate extent of the soils*—Continued

Soil	Area	Extent
	Acres	*Percent*
Parker cobbly loam, 3 to 15 percent slopes	10,000	3.6
Parker cobbly loam, 15 to 25 percent slopes	4,250	1.5
Pattenburg gravelly loam, 2 to 6 percent slopes	4,850	1.8
Pattenburg gravelly loam, 6 to 12 percent slopes, eroded	5,850	2.2
Pattenburg gravelly loam, 12 to 18 percent slopes	970	.4
Pattenburg gravelly loam, 18 to 40 percent slopes	1,300	.5
Pattenburg gravelly loam, moderately wet, 2 to 6 percent slopes	940	.3
Penn shaly silt loam, 2 to 6 percent slopes	13,000	4.7
Penn shaly silt loam, 6 to 12 percent slopes, eroded	15,000	5.5
Penn shaly silt loam, 12 to 18 percent slopes	4,000	1.5
Penn-Bucks complex, 2 to 6 percent slopes	5,150	1.9
Penn-Bucks complex, 6 to 12 percent slopes, eroded	1,040	.4
Pope fine sandy loam, high bottom	1,800	.7
Quakertown silt loam, 0 to 2 percent slopes	190	.1
Quakertown silt loam, 2 to 6 percent slopes	6,300	2.3
Quakertown silt loam, 6 to 12 percent slopes eroded	2,190	.8
Quakertown silt loam, 12 to 18 percent slopes, eroded	200	.1
Quakertown-Chalfont silt loams, 6 to 12 percent slopes, eroded	230	.1
Raritan silt loam, 0 to 2 percent slopes	1,150	.4
Raritan silt loam, 2 to 6 percent slopes	1,590	.6
Readington silt loam, 2 to 6 percent slopes	1,380	.5
Readington silt loam, 6 to 12 percent slopes, eroded	240	.1
Reaville silt loam, 0 to 2 percent slopes	840	.3
Reaville silt loam, 2 to 6 percent slopes	6,150	2.2
Reaville silt loam, 6 to 12 percent slopes, eroded	770	.3
Reaville silt loam, wet variant, 0 to 2 percent slopes	880	.3
Reaville silt loam, wet variant, 2 to 6 percent slopes	820	.3
Riverhead gravelly sandy loam, 2 to 6 percent slopes	260	.1
Riverhead gravelly sandy loam, 6 to 18 percent slopes	210	.1
Rock land, Edneyville material	550	.2
Rough broken land, shale	5,000	1.8
Rowland silt loam	7,100	2.6
Steep stony land, Parker material	14,100	5.2
Turbotville loam, 2 to 6 percent slopes	590	.2
Washington loam, 2 to 6 percent slopes	1,800	.6
Washington loam, 6 to 12 percent slopes, eroded	660	.3
Watchung silt loam	160	.1
Total	[2] 274,800	100.0

[1] Less than 0.05 percent.
[2] Land area; water area totals, 3,600 acres; pits and gravel area totals, 180 acres.

Abbottstown Series

The Abbottstown series consists of deep, nearly level to gently sloping, somewhat poorly drained soils that formed in material weathered from red and brown shale and sandstone. These soils commonly are loamy, have distinct mottles in the subsoil, and are slowly permeable in the subsoil. They occupy slightly concave uplands.

In a representative profile, in a cultivated area, the plow layer is dark-brown silt loam about 8 inches thick. The subsurface layer is 8 inches of strong-brown silt loam. The upper part of the subsoil is a fragipan of reddish-brown, prominently mottled, firm silt loam about 20 inches thick. The lower part of the subsoil, about 6 inches thick, is reddish-brown silty clay loam that has distinct mottles. It is very firm. Shale fragments in the lower part of the subsoil increase in number with depth, and weathered red shale bedrock is at a depth of about 42 inches.

Permeability is moderate in the surface layer and slow in the subsoil. The available water capacity is high and natural fertility is moderate, but root growth is restricted by the fragipan. Natural reaction is medium acid to strongly acid, but limed fields are not so acid.

Abbottstown soils are saturated from late in fall until spring. Frost heaving is a severe hazard, and spring plowing frequently is delayed. In places in cultivated areas, erosion needs to be controlled on gently sloping soils.

If these soils are drained, they are suited to corn, soybeans, grain, hay, and pasture. They are not well suited to alfalfa and fruit. Most areas have been cleared for farming. The excess water limits the use of these soils for homesites and septic systems.

Representative profile of Abbottstown silt loam, 0 to 2 percent slopes, near Ringoes, along the east side of Route 202:

Ap—0 to 8 inches, dark-brown (7.5YR 4/4) silt loam; weak, fine, granular structure; soft when dry, friable when moist; many roots; strongly acid; clear, smooth boundary.

A2—8 to 16 inches, strong-brown (7.5YR 5/6) silt loam; common, fine, faint, brownish-yellow (10YR 6/6) mottles; moderate, thin, platy structure; friable; many roots; strongly acid; clear, smooth boundary.

Bx1—16 to 36 inches, reddish-brown (2.5YR 4/4) heavy silt loam; many, medium, prominent, strong-brown (7.5YR 5/6) and light-gray (10YR 7/1) mottles; strong, very coarse, prismatic structure parting to moderate, thin, platy; firm; few roots; continuous thick clay films on ped faces; few shale fragments; medium acid; gradual, wavy boundary.

Bx2—36 to 42 inches, reddish-brown (5YR 4/4) light silty clay loam; many, medium, distinct, strong-brown (7.5YR 5/6) and light brownish-gray (10YR 6/2) mottles; strong, very coarse, prismatic structure parting to moderate, thin, platy; very firm; continuous thick clay films on ped faces; many shale fragments, increasing in number with depth; strongly acid; abrupt, smooth boundary.

R—42 inches, weak-red (10R 4/3), partly weathered shale; fragments in upper 6 inches can be broken in fingers but not those below that depth; rock structure dominates.

The solum is 35 to 50 inches thick. Depth to bedrock ranges from 40 to 55 inches. Depth to the fragipan generally ranges from 15 to 30 inches. Pan development ranges from moderate to strong. Shale fragments range from 5 to 15 percent in the upper part of the solum, from 10 to 30 percent in the lower part of the solum, and from 10 to 50 percent in the C horizon.

The Ap horizon ranges from 10YR to 5YR in hue, has a value of 3 or 4, and ranges from 2 to 4 in chroma. In many

places the Ap horizon formed in a thin silt deposit. The B horizon color has a matrix hue ranging from 5YR to 2.5YR, value is 4 or 5, and chroma ranges from 1 to 4. Mottles generally begin at a depth of 8 inches. Mottles in the B horizon are distinct or prominent with some chromas of 2 or less at depths between 12 and 20 inches. The B horizon texture is silt loam to silty clay loam. In places a C horizon of silt loam or silty clay loam is between the solum and the bedrock.

Abbottstown soils adjoin Bucks, Penn, Readington, and Reaville soils. Their mottled B horizon disinguishes them from Bucks and Penn soils. They are mottled closer to the surface than Readington soils. Abbottstown soils are deeper to bedrock than Reaville soils.

Abbottstown silt loam, 0 to 2 percent slopes (AbA).—This soil has the profile described as representative for the series, but in many places the silt loam surface layer is thicker than that in the profile described because of deposits washed from nearby soils. Shale fragments generally are lacking in the surface layer.

Wetness is the major limitation. Drainage by open ditches and diversion of water upslope can be used to control wetness. Capability unit IIIw–70; woodland group 3w1.

Abbottstown silt loam, 2 to 6 percent slopes (AbB).—This soil has a profile similar to the one described as representative for the series. In places the original surface layer has been thinned several inches by erosion. In some fields there are a few gullies. In places shale fragments cover 2 to 10 percent of the surface and make up 2 to 10 percent of the profile. Calcareous shale is interbedded with acid shale in some areas, particularly north of Flemington.

Included with this soil in mapping, in a few places where this soil is associated with Lansdale soils, is a more sandy soil. Small areas of better drained soils were included in most mapped areas.

Artificial drainage and diversion of water upslope have been used to control wetness. Long slopes that are cultivated continuously need to be protected against runoff and erosion. Capability unit IIIw–70; woodland group 3w1.

Alluvial Land

Alluvial land is on flood plains and is subject to frequent overflow. The material is so variable that a representative profile cannot readily be selected.

Alluvial land, loamy (Ac) consists of nearly level soil material along the Musconetcong River, the South Branch of the Raritan River, and other streams. In most places the surface layer is loam. The underlying material is loam or sandy loam in texture and is 15 to 50 percent gravel and cobblestones. In most places the underlying rock is gneiss or limestone, and the soil material generally contains gravel and cobblestones of gneiss, limestone, and slate that were washed from the adjacent uplands.

Flooding is most common early in spring. The water table is at a depth of 1 to 2 feet in spring and several feet deeper in summer. Available water capacity is high. Permeability is moderate to moderately rapid. Reaction ranges from strongly acid to neutral. Drainage in most areas is moderately good to somewhat poor in most places.

Some areas of Alluvial land, loamy, are used to grow corn, but most areas are in pasture or trees or are idle. Drainage ditches are used in some areas to remove excess water. Capability unit IIw–79; woodland group 2w2.

Alluvial land, loamy, wet (Ae) consists of nearly level, wet soil material in long, narrow areas adjacent to perennial streams. In most places the surface layer is loam or sandy loam that is underlain by gravelly loam or gravelly sandy loam.

Permeability is moderately rapid. Reaction is strongly acid to neutral. In places the seasonal high water table is close to the surface or causes surface ponding late in fall and winter and early in spring. Drainage is poor or very poor. Most of the acreage is flooded for a short time after a storm of high intensity, but some depressions remain ponded for longer periods.

Alluvial land, loamy, wet, is used for hay and pasture. Much of the acreage remains in trees or brush. Capability unit IIIw–86; woodland group 2w2.

Annandale Series

The Annandale series consists of deep, gently sloping to strongly sloping, well-drained, loamy soils that formed in old glacial drift or colluvium of highly weathered granitic gneiss. Angular fragments of gneiss, as much as 2 feet in diameter, commonly make up as much as 25 percent of the profile. In the landscape these soils occupy high positions.

In a representative profile the surface layer is dark yellowish-brown gravelly loam about 9 inches thick. The upper 26 inches of the subsoil is strong-brown, friable to very firm clay loam. The lower 8 inches is a fragipan of strong-brown, firm clay loam. At a depth of 43 inches is the substratum of reddish-yellow, firm silt loam.

Permeability is moderate in the surface layer and substratum and moderately slow to slow in the subsoil. The available water capacity is high, and natural fertility is moderate. Natural reaction is medium acid above the fragipan and strongly acid in the fragipan and substratum. Limed fields generally are not so acid.

Most Annandale soils originally contained many stones. Extensive areas have been cleared of stones prior to farming. The gently sloping soils are suited to corn, small grain, soybeans, orchard crops (fig. 4), hay, or pasture. Steeper soils are suited to hay, pasture, or trees. Control of erosion is needed in cultivated areas.

Figure 4.—**Apple trees on Annandale gravelly loam near Oldwick.**

Representative profile of Annandale gravelly loam, 3 to 8 percent slopes, in a hayfield along the south side of Route 512, 200 feet west of Route 517, at Fairmount:

Ap—0 to 9 inches, dark yellowish-brown (10YR 4/4) gravelly loam; moderate, medium and fine, granular structure; friable; many fine and medium roots; 15 percent gneissic coarse fragments as much as 4 inches in diameter; medium acid; abrupt, smooth boundary.

B21t—9 to 15 inches, strong-brown (7.5YR 5/6) clay loam; moderate, medium, subangular blocky structure; friable; many medium roots; thin, discontinuous, slightly shiny coatings on ped faces; 5 percent gneissic coarse fragments 3 to 6 inches in diameter; many manganese stains; many pores and root and worm channels filled with Ap horizon material; medium acid; gradual, wavy boundary.

B22t—15 to 35 inches, strong-brown (7.5YR 5/6) clay loam; moderate to strong, medium, subangular blocky structure; firm to very firm in lower part of horizon; very few medium roots near top of horizon; thick, discontinuous, shiny red coating on ped faces; 5 percent strongly weathered, angular, gneissic coarse fragments 3 to 6 inches in diameter; many manganese stains; medium acid; gradual, wavy boundary.

Bx—35 to 43 inches, strong-brown (7.5YR 5/6) light clay loam; moderate, coarse, subangular to angular blocky structure; firm, slightly brittle; patchy, thin, slightly shiny coatings on some ped faces; 5 percent strongly weathered, coarse fragments of gneiss, 3 to 6 inches in diameter; few manganese stains; strongly acid; clear, wavy boundary.

C—43 to 60 inches reddish-yellow (7.5YR 6/6) silt loam, variegated with strong brown (7.5YR 5/6), light yellowish brown (2.5Y 6/4), and light olive brown (2.5Y 5/4); massive; firm; 10 percent soft gneissic coarse fragments 3 to 7 inches in diameter; strongly acid.

The solum ranges from 40 to 50 inches in thickness. Depth to the fragipan is 24 to 36 inches. Depth to bedrock is 6 to 10 feet or more. Angular fragments of gneiss as much as 10 inches in diameter make up most of the coarse material. Small amounts of quartz, quartzite, and chert fragments are common in places.

The Ap horizon has a hue of 10YR, a value of 4, and a chroma of 2 to 4. The A2 horizon, where present, has a hue of 10YR or 7.5YR, a value of 6 or 7, and a chroma of 4 to 6.

The Bt horizon has a hue of 7.5YR or 10YR, a value of 5 or 6, and a chroma of 6 or 8. Texture is heavy loam or clay loam. The Bx horizon has about the same range in color as the B2t horizon but includes some paler colors on major vertical surfaces. Texture of the Bx horizon is clay loam or silty clay loam.

The C horizon has a hue of 7.5YR or 10YR, a value of 5 or 6, and a chroma of 6 to 8. The horizon is commonly variegated because of differences in the soft weathered fragments. In places the C horizon is very firm. At depths of more than 60 inches generally is deeply weathered, fine, gravelly saprolite.

Annandale soils adjoin Edneyville, Parker, and Califon soils. They are more clayey and less cobbly than Parker soils and are deeper to permeable material and firmer than Edneyville soils. They lack the mottles that are characteristic of Califon soils.

Annandale gravelly loam, 3 to 8 percent slopes (AnB).—This soil has the profile described as representative for the series. Included in mapping are small areas where slope is less than 3 percent, small areas of Califon soils, and areas of Annandale soils that have a surface layer of loam or silt loam. Also included are some areas of eroded soil in which organic matter has been lost, tilth is impaired, infiltration is slower, and runoff is more rapid. In some of these areas, concentrated runoff has produced shallow gullies. Locally, the soil is redder because the underlying gneiss is darker colored.

Stripcropping and diversion terraces can be used on the longer slopes to check runoff and to reduce the erosion hazard. Capability unit IIe–53, woodland group 2o1.

Annandale gravelly loam, 8 to 15 percent slopes, eroded (AnC2).—This soil has a profile similar to that described as representative for the series, except that erosion has thinned the original surface layer by several inches and the more clayey subsoil is mixed into the plow layer. Gullies are common. Included in mapping are areas of other loamy soils and small areas of woodland where stones have not been removed.

The plow layer of this soil is lower in content of organic matter than the plow layer of a less eroded soil, and is therefore more difficult to work. Runoff is rapid, and the erosion hazard is moderately severe. Cover crops, contour stripcropping, diversion terraces, and cropping systems that include sod can be used to reduce the erosion hazard. Capability unit IIIe–53; woodland group 2o1.

Annandale and Edneyville gravelly loams, 3 to 8 percent slopes (ApB).—This mapping unit is about 60 percent Annandale gravelly loam and about 40 percent Edneyville gravelly loam, but both of these soils are not in every mapped area.

The Edneyville soil in this unit is redder than that in the profile described for the Edneyville series, and it contains red shale or sandstone particles in addition to the dominant gneiss. The bedrock generally is red sandy shale that is calcareous in places. The soils vary widely in permeability because of vertical as well as horizontal variability between firm till and stratified sand and gravel, all of which is very thoroughly weathered.

Corn, small grains, soybeans, hay, and pasture are suitable crops. On long slopes contour stripcropping can be used to reduce runoff and the hazard of erosion. The gravel and sand in these soils are too weathered or soft to be used in concrete but are used as road fill. Capability unit IIe–53; woodland group 2o1.

Annandale and Edneyville gravelly loams, 8 to 15 percent slopes (ApC).—This unit is about 60 percent Annandale gravelly loam and 40 percent Edneyville gravelly loam, but both of these soils are not always in every mapped area. The Edneyville soil is redder than that described in the representative profile for the Edneyville series, and it contains red shale or sandstone particles in addition to gneiss, which is dominant. The bedrock generally is red sandy shale, which is calcareous in places. The soils vary widely in permeability because of vertical and horizontal variability between firm till and stratified sand and gravel, all of which is thoroughly weathered. Included in mapping are very small areas of soils that have slopes of more than 15 percent.

Suitable crops are corn, soybeans, small grain, hay, and pasture. Runoff is rapid, and the erosion hazard is moderately severe. In cultivated fields contour stripcropping supplemented by diversion terraces and grassed waterways is used to reduce the erosion hazard. Capability unit IIIe–53; woodland group 2o1.

Athol Series

The Athol series consists of deep, gently sloping to moderately steep, well-drained soils that have a yellowish-red and reddish-brown gravelly loam subsoil. These soils formed in glacial drift consisting of gneiss, chert, basal

conglomerate, and shale over red, calcareous conglomerate.

In a representative profile the surface layer is reddish-brown gravelly loam about 10 inches thick. The subsoil is friable, yellowish-red and reddish-brown gravelly loam about 39 inches thick. It is underlain by a red gravelly sandy loam substratum. Bedrock is at a depth of about 75 inches.

Athol soils are moderately permeable throughout their profiles. Available water capacity is moderately high, and natural fertility is moderate. Natural reaction is strongly acid in the surface layer and grades with depth to slightly acid in the substratum.

Most areas of this soil have been cleared for farming. The gentle slopes are suited to corn, small grain, soybeans, hay, or pasture; steeper slopes are suited to hay, pasture, or trees. Control of erosion is needed in cultivated areas.

Representative profile of Athol gravelly loam, 2 to 6 percent slopes, in a reforested area, 1.6 miles north of Potterstown:

Ap—0 to 10 inches, reddish-brown (5YR 4/4) gravelly loam; weak, medium, granular structure; friable; many fine and medium roots; 15 percent gravel, few cobblestones; strongly acid; abrupt, smooth boundary.

B2t—10 to 32 inches, yellowish-red (5YR 5/6) heavy gravelly loam; very weak, fine, subangular blocky structure; friable; many medium and coarse roots; 15 percent gravel, few cobblestones; thin clay films on ped faces; strongly acid; gradual, wavy boundary.

B3—32 to 49 inches, reddish-brown (2.5YR 4/4) gravelly loam; very weak, medium, subangular blocky structure; friable; 20 percent gravel, cobblestones, and stones; patchy clay films on some ped faces, some clay bridging; medium acid; gradual, smooth boundary.

C—49 to 75 inches, red (2.5YR 4/6) gravelly sandy loam; massive; friable; 25 percent gravel, cobblestones, and stones; slightly acid.

R—75 inches, reddish, calcareous sandy shale or conglomerate bedrock.

The solum ranges from 40 to 55 inches in thickness. Depth to bedrock is 4 to 7 feet. In the A horizon the content of gravel ranges from 0 to 20 percent and in the B horizon from 5 to 30 percent. In the Ap horizon hue ranges from 10YR to 5YR, value is 4 or 5, and chroma is 3 or 4. The B horizon ranges from loam to clay loam. The hue is 5YR and 2.5YR, and the value is 4 or 5. The C horizon is gravelly loam or gravelly sandy loam. The hue ranges from 7.5YR to 2.5YR, value is 3 to 5, and chroma is 4 to 6.

Athol soils adjoin Annandale, Califon, Penn, Berks, and Washington soils. They lack the fragipan that is characteristic of Annandale and Califon soils and are deeper than Penn and Berks soils. Athol soils are redder and contain more gravel than Washington soils.

Athol gravelly loam, 2 to 6 percent slopes (AtB).—This soil has the profile described as representative for the series. On short slopes there is little hazard of erosion. Included in mapping are a few small areas where the original surface layer has been eroded to the extent that the heavier subsoil is mixed with the plow layer. Also included are a few scattered gullies and some small areas that are shallow to rock.

This soil is suited to corn, small grain, hay, or pasture. On long slopes contour stripcropping can be used to reduce runoff and erosion. Capability unit IIe–54; woodland group 2o1.

Athol gravelly loam, 6 to 12 percent slopes, eroded (AtC2).—This soil has a profile similar to that described as representative for the series, except that in many places erosion has thinned the original surface layer several inches, and the more clayey part of the subsoil is mixed into the plow layer. Shallow gullies are common. Included in mapping are small areas where the soil is less than 40 inches deep.

The plow layer is low in organic matter and is difficult to till. Runoff is rapid, and the erosion hazard is moderately severe. Cover crops, contour stripcropping, diversion terraces, and cropping systems that include sod can be used to reduce further erosion of this soil. Capability unit IIIe–54; woodland group 2o1.

Athol gravelly loam, 12 to 18 percent slopes, eroded (AtD2).—This soil has a profile similar to the one described as representative for the series, except that erosion has thinned the original surface layer so that the lighter colored material in the upper part of the subsoil is mixed into the plow layer. In places the subsoil is completely exposed. Included in mapping are small areas where slopes are greater than 18 percent and areas where the soil has retained most of its original surface layer. Shallow gullies are common in many fields. Rapid runoff, severe erosion, and steepness limit the use of this soil for farming. It is poorly suited to continuous row crops; therefore, it should be cultivated only rarely in a cropping system that has long hay rotation. Capability unit IVe–55; woodland group 2o1.

Bedington Series

The Bedington series consists of deep, gently sloping to strongly sloping, well-drained soils that have large amounts of acid shale fragments in the lower part. These soils occupy a small section of the Piedmont Plateau west of Clinton.

In a representative profile the surface layer is dark-brown shaly silt loam 8 inches thick. The subsoil is friable to slightly firm, light yellowish-brown or reddish-yellow shaly silt loam in the upper 18 inches and friable, strong-brown shaly loam in the lower 24 inches. The substratum is very shaly loam about 10 inches thick. Shale bedrock is at a depth of about 60 inches.

Permeability is moderate. Because of the high content of shale fragments, the soils have a moderate available water capacity. Natural reaction is strongly acid to extremely acid.

Bedington soils are well suited to corn, soybeans, small grain, hay, and pasture. The soils are erodible if farmed.

Representative profile of Bedington shaly silt loam, 2 to 6 percent slopes, in an idle field, 1.5 miles northwest of Clinton:

Ap—0 to 8 inches, dark-brown (10YR 4/3) shaly silt loam; weak, fine and medium, granular structure; friable; many fine and coarse roots; 20 percent shale fragments; strongly acid; abrupt, smooth boundary.

B1—8 to 14 inches, light yellowish-brown (10YR 6/4) shaly silt loam; weak, medium and fine, subangular blocky structure; friable; 20 percent shale fragments; many medium roots; strongly acid; gradual, wavy boundary.

B2t—14 to 26 inches, reddish-yellow (7.5YR 6/6) heavy shaly silt loam; moderate, medium and fine, subangular blocky structure; slightly firm; very few medium roots; very patchy, thin, darker colored, nonshiny coatings on ped faces in places; 20 percent shale fragments; strongly acid; clear, wavy boundary.

B3t—26 to 50 inches, strong-brown (7.5YR 5/6) shaly loam; massive; 40 percent shale fragments; friable; clay films on many shale fragments; strongly acid; gradual, diffuse boundary.

C—50 to 60 inches, dark reddish-brown (5YR 3/4) and yellow (10YR 7/) variegated very shaly loam; massive; 50 to 70 percent shale fragments; many large pores; strongly acid; abrupt, irregular boundary.
R—60 inches, interbedded dark reddish-brown (5YR 3/4) and yellow (10YR 7/6) hard shale bedrock.

The solum ranges from 42 to 60 inches in thickness. Depth to bedrock ranges from 4 to 5½ feet. All horizons in the solum commonly are 15 to 30 percent hard shale fragments, and most horizons contain some hard shale. The Ap horizon has a hue of 10YR or 7.5YR, a value of 4, and a chroma of 2 or 3. In the B horizon the hue is 7.5YR to 10YR, the value is 4 to 6, and the chroma is 4 to 6.

Bedington soils adjoin Berks, Duffield, and Washington soils. They are less shaly and are deeper over bedrock than Berks soils. They are less clayey and more shaly than Duffield and Washington soils.

Bedington shaly silt loam, 2 to 6 percent slopes (BaB).—This soil has the profile described as representative for the series. In places shallow gullies are in fields.

Included with this soil in mapping are small areas of moderately eroded soils that have the slightly heavier upper part of the subsoil mixed with the plow layer. Shale fragments tend to concentrate in these areas. Also included are a few small spots where the soil is slightly less well drained than this one. The plow layer contains moderate amounts of organic matter and is easy to till. On the short slopes there is little or no erosion. On long slopes contour stripcropping can be used to reduce runoff and erosion. Capability unit IIe–53; woodland group 2o1.

Bedington shaly silt loam, 6 to 12 percent slopes, eroded (BaC2).—This soil has a profile similar to the one described as representative for the series, but erosion has thinned the original surface layer several inches. As a result, material from the slightly heavier upper part of the subsoil is mixed into the plow layer, and shale tends to concentrate on the surface. Included in mapping are extensive areas of only slightly eroded soils.

Runoff is rapid, and the erosion hazard is moderately severe. Cover crops, contour stripcropping, diversion terraces, and cropping systems that include sod are used to reduce the hazard of further erosion. Capability unit IIIe–53; woodland group 2o1.

Berks Series

The Berks series consists of moderately deep, gently sloping to moderately steep, well-drained shaly soils that are very shaly in the lower part of the subsoil that overlies shale bedrock. The soils occupy areas of the Piedmont Plateau west of Clinton. The shale is fairly hard and slaty.

In a representative profile the plow layer is dark-brown shaly loam about 6 inches thick. The subsoil is very slightly firm, strong-brown shaly loam and massive very shaly loam about 20 inches thick. The underlying material is loose, weathered shale about 8 inches thick. Hard shale bedrock is at a depth of about 34 inches.

Permeability is moderately rapid in these soils. Because of the moderate depth and the shale content, Berks soils have a low available water capacity. They are only fairly well suited to corn, wheat, hay, and pasture. The soil is erodible if farmed.

Representative profile of Berks shaly loam, 2 to 6 percent slopes, west of Clinton on the south side of Interstate Highway 78:

Ap—0 to 6 inches, dark-brown (10YR 4/3) shaly loam; fine granular structure; friable; many roots; 25 percent shale fragments; medium acid; abrupt, smooth boundary.
B2—6 to 12 inches, strong-brown (7.5YR 5/6) heavy shaly loam; weak, fine, subangular blocky structure; very slightly firm; many roots; 25 percent shale fragments, ½ inch to 2 inches in length; medium acid; clear, smooth boundary.
B3—12 to 26 inches, strong-brown (7.5YR 5/6) very shaly loam; massive; few roots; 60 percent shale fragments, ½ inch to 2 inches in length; strongly acid; diffuse, wavy boundary.
C—26 to 34 inches, disrupted shale fragments.
R—34 inches, variegated shale bedrock.

The solum ranges from 18 to 36 inches in thickness. Depth to bedrock ranges from 20 to 40 inches. The content of shale fragments generally increases with depth. In the A horizon this content ranges from 10 to 50 percent; in the B horizon it ranges from 25 to 60 percent; and in the C horizon it ranges from 60 to 80 percent. The Ap horizon has a hue of 10YR, a value of 3 or 4, and a chroma of 3. Uncultivated areas have a light brownish-gray A1 horizon 2 to 4 inches thick.

The B horizon has a hue ranging from 7.5YR to 10YR, a value of 4 or 5, and a chroma of 6 to 8. The texture ranges from shaly to very shaly loam or silt loam.

The C horizon ranges from brown to gray or red, depending on the color of the underlying bedrock. In places this horizon is missing.

Berks shaly loam, 2 to 6 percent slopes (BbB).—This soil has the profile described as representative for the series. Included in mapping are areas of Bedington soils and shallow Klinesville soils, a few areas of soils that have a silt loam or shaly silt loam surface layer, and some areas of moderately well drained soils. Shallow gullies are common.

Corn, small grain, and grasses generally are the crops grown on this soil. Alfalfa grows moderately well.

In addition to overall good management, stripcropping and diversion terraces can be used to conserve moisture and to protect this soil from erosion. Growing grasses and legumes periodically helps to improve the structure of the soil and to maintain the content of organic matter. Capability unit IIe–65; woodland group 3f1.

Berks shaly loam, 6 to 12 percent slopes, eroded (BbC2).—This soil has a profile similar to the one described as representative for the series, except that as a result of sheet erosion it is a few inches shallower to shale bedrock. Runoff is rapid because of the strong slopes, and the erosion hazard is moderately severe. Shallow gullies are common, and shale content is slightly more than is typical for less eroded Berks soils. The content of organic matter is low. Because of the shallowness and the erosion hazard, this soil is poorly suited to continuous row crops. Hay can be used in the cropping system in a long rotation with row crops to help prevent further erosion. Capability unit IIIe–65; woodland group 3f1.

Berks shaly loam, 12 to 18 percent slopes, eroded (BbD2).—The content of shale is somewhat greater in this soil than in the soil described as representative for the series. Depth to bedrock is about 2 feet. Slopes are moderately steep, and the erosion hazard is severe. Content of organic matter is extremely low, runoff is rapid, and gullies are common.

This soil is best suited to drought-resistant grasses and legumes used for hay or pasture. Capability unit IVe–65; woodland group 3f1.

Birdsboro Series

The Birdsboro series consists of deep, nearly level to strongly sloping, well-drained soils that have a stratified sandy or gravelly substratum. These soils formed in deposits of mostly silt loam alluvium derived from material weathered mainly from shale and sandstone. They are on stream terraces above the flood level of the Raritan River, Neshanic River, Back Brook, and other smaller streams in the southern part of the county.

In a representative profile the surface layer is dark yellowish-brown silt loam about 8 inches thick. The subsoil is strong-brown friable to very friable silt loam about 32 inches thick, and the substratum is stratified, dark-brown to reddish-brown silt loam, silty clay loam, and sand.

Birdsboro soils are moderately permeable except in the sandy substratum where they are moderately rapidly permeable. Natural fertility is moderate, and the available water capacity is high. Natural reaction is strongly acid, but soils in fields that have been limed are less acid. The gently sloping to strongly sloping soils are erodible.

Most of the acreage has been cleared for farming. These soils are suited to corn (fig. 5), small grain, and soybeans.

Representative profile of Birdsboro silt loam, 0 to 2 percent slopes, in a cultivated field at Flemington Junction near the crossroad to Barley Sheaf:

Ap—0 to 8 inches, dark yellowish-brown (10YR 3/4) silt loam; moderate, medium and fine, granular structure; very friable; many fine and medium roots; 3 percent quartz pebbles; slightly acid; abrupt, smooth boundary.

B1—8 to 13 inches, strong-brown (7.5YR 5/6) silt loam; moderate, medium, subangular blocky structure; friable; many medium and fine roots; 3 percent small quartz pebbles; medium acid; gradual, wavy boundary.

B21t—13 to 21 inches, strong-brown (7.5YR 5/6) heavy silt loam; moderate, medium, subangular block structure; friable; many medium and coarse roots; discontinuous thin clay films on ped faces; 3 percent quartzite and sandstone pebbles; slightly acid; gradual, wavy boundary.

B22t—21 to 29 inches, strong-brown (7.5YR 5/6) heavy silt loam; moderate, medium and coarse, subangular blocky structure; friable; few coarse and medium roots; continuous moderately thick clay films on ped faces; 5 percent coarse fragments of quartzite, shale, and gneiss; slightly acid; clear, wavy boundary.

B3—29 to 40 inches, strong-brown (7.5YR 5/6) light silt loam; massive; very friable; discontinuous coating on soil particles; 5 percent coarse fragments of quartzite, sandstone, and gneiss; strongly acid; gradual, irregular boundary.

C1—40 to 45 inches, variegated, dark-brown (7.5YR 4/4) and reddish-brown (2.5 YR 4/4) silt loam; massive; firm; 10 percent quartzite fragments; medium acid or slightly acid; gradual, wavy boundary.

C2—45 to 60 inches, reddish-brown (2.5YR 4/4) silty clay loam; massive; very firm; black manganese stains on soil partings; strongly acid.

IIC3—60 inches, reddish-brown (2.5YR 4/4) stratified, fine and very fine sand; gravel in places; massive; firm in place, very friable when removed; strongly acid.

The solum is 30 to 50 inches thick. Depth to bedrock is 5 to 10 feet or more. Fine shale fragments are nearly lacking in the upper part of the soils, but in the individual subhorizons they vary in amount and tend to increase with depth. In some areas quartzite and gneiss pebbles are common in these soils.

Figure 5.—A field of corn on Birdsboro silt loam, 0 to 2 percent slopes. Wooded areas in background are Hazleton channery loam, 12 to 18 percent slopes.

The A horizon is dark yellowish brown, dark reddish brown, or redder colors. In the B horizon the hue ranges from 7.5YR to 2.5YR, the value is 3 to 5, and the chroma is 4 to 6. The B horizon is heavy silt loam, clay loam, heavy loam, or silty clay loam. The IIC horizon has a hue of 2.5YR. The texture depends on stratification and ranges from clay loam to sand that is 10 to 80 percent gravel, shale, or cobblestones.

Birdsboro soils adjoin Bucks, Penn, Raritan, Rowland, and Bowmansville soils and grade toward them. They are on terraces and are underlain by a sandier material than that underlying the Bucks soils. Birdsboro soils are much deeper than Penn soils; and they lack the mottling that is characteristic of Rowland, Bowmansville, and Raritan soils.

Birdsboro silt loam, 0 to 2 percent slopes (BdA).—This soil has the profile described as representative for the series. Most areas of this soil are on high terraces where flooding occurs about once every 100 years, but some are on lower terraces that are flooded about once every 25 years.

Included with this soil in mapping are a few areas along the Delaware River where the surface layer is loam, and the subsoil is slightly more clayey than that of this soil. Also included are soils on terraces along the upper reaches of the South Branch of the Raritan River that are redder and contain more sand throughout their profiles. In addition, about 100 acres of soils on the first terrace along the Musconetcong River are included. In these soils texture of the surface layer, acidity, depth to gravel, and calcareousness of the gravel are more variable than in soils in other areas in the county.

This soil is suited to a variety of crops, including vegetables. Runoff and erosion are slight hazards and can be controlled by good management. Capability unit I–55; woodland group 2o1.

Birdsboro silt loam, 2 to 6 percent slopes (BdB).—This soil has a profile similar to the one described as representative for the series. Areas are seldom, if ever, flooded.

Included with this soil in mapping are small areas on high terraces along the Delaware River that have a loamy surface layer and a slightly more clayey subsoil. Also included are small areas of soils on terraces along the upper reaches of the South Branch of the Raritan River that are sandier than this soil and redder throughout their profile. Some included areas have gravel and sandy loam or loamy sand at a depth of 2 to 3 feet, and in a few areas gravel is at the surface. In other areas the lower part of the subsoil or the substratum is very firm. In addition about 200 acres are included along the Musconetcong River where the soil on the first terrace above the flood plain is quite variable in depth to gravel, acidity, texture of the surface layer, and presence of a calcareous gravel substratum.

This soil is suited to a variety of crops, including vegetables. Contour stripcropping and diversion terraces can be used to reduce the moderate erosion hazard, especially on the steeper slopes. Capability unit IIe–55; woodland group 2o1.

Birdsboro silt loam, 6 to 12 percent slopes, eroded (BdC2).—This soil has a profile similar to that described as representative for the series. Included in mapping are soils on terraces along the Delaware River that have a loam surface layer and a more clayey subsoil, and some small areas where slopes are greater than 12 percent. Gullies are common.

Runoff is rapid, and the erosion hazard is moderately severe. Content of organic matter is more difficult to maintain, and the soil tends to be more droughty than the less sloping Birdsboro soils. Stripcropping, diversion terraces, and cropping systems can be used to reduce the runoff and erosion in farmed areas. Capability unit IIIe–55; woodland group 2o1.

Bowmansville Series

Bowmansville soils are deep, poorly drained to somewhat poorly drained, and nearly level. They are on flood plains that are subject to very frequent flooding.

In a representative profile the plow layer is dark reddish-gray silt loam about 8 inches thick. The subsoil is mottled, dark reddish-gray, friable silt loam about 16 inches thick. The substratum is mottled, reddish-brown silt loam to a depth of about 60 inches.

Bowmansville soils are moderately permeable to moderately slowly permeable. Natural fertility is moderate, and available water capacity is high. Natural reaction is very strongly acid or strongly acid, but fields that have been limed are less acid.

Most areas of the Bowmansville soils have been cleared and are used as pasture, but some areas are now covered with trees and others are reverting to trees. The major limitations for crops are frequent flooding and the seasonal high water table. These soils are suitable for pasture or woodland.

Representative profile of Bowmansville silt loam, in a pasture 50 feet south of Copper Hill School Road, 0.75 mile east of Route 31:

Ap—0 to 8 inches, dark reddish-gray (5YR 4/2) silt loam; common, medium and coarse, faint yellowish-red (5YR 4/8) mottles; friable, nonsticky when wet; many fine and medium roots; very strongly acid; abrupt, smooth boundary.

Bg—8 to 24 inches, dark reddish-gray (5YR 4/2) silt loam; few, fine, distinct, gray (N 5/0) and yellowish-red (5YR 4/8) mottles; moderate, medium, prismatic structure parting to weak, very thick, platy; friable, slightly sticky when wet; many medium and coarse roots in upper 15 inches; less than 1 percent shale fragments; very strongly acid; gradual, wavy boundary.

C—24 to 60 inches, reddish-brown (5YR 4/3) silt loam; common, medium and coarse, distinct, yellowish-red (5YR 4/8) mottles; massive; friable, slightly sticky when wet; 3 percent fine shale fragments; medium acid.

The solum ranges from 24 to 40 inches in thickness. The gravelly or sandy IIC horizon is at a depth of more than 40 inches in most places, and in some it is at a depth of more than 60 inches. Coarse fragments of rounded shale make up 0 to 10 percent of the A, B, and C horizons and 10 to 90 percent of the IIC horizon. The fragments in the IIC horizon are mainly gneiss, quartzite, and sandstone pebbles and cobblestones.

The A horizon ranges from 5YR to 7.5Y in hue, has a value of 4, and ranges from 2 to 4 in chroma. The B and C horizons range from 2.5YR to 5YR in hue, from 4 to 6 in value, and from 2 to 4 in chroma.

Mottles in the B and C horizons are distinct to prominent and are fine to medium in size. Low chromas are dominant to a depth of 2 feet or more. The C horizon is silt loam, silty clay loam, or clay loam. The IIC horizon is gravel, sand, or gravelly loam.

Bowmansville soils adjoin Penn, Klinesville, Rowland, and Birdsboro soils. They have gray mottles that are lacking in Birdsboro soils and are closer to the surface than those in Rowland soils. Bowmansville soils are deeper to rock than the moderately deep Penn soils and the shallow Klinesville soils.

Bowmansville silt loam (Bt).—This is the only Bowmansville soil mapped in the county. Slopes generally are 0 to 2 percent.

Included with this soil in mapping are some small areas of slightly more sloping soils and areas where very slowly permeable silty clay is at a depth of 2 to 4 feet. Also included are a few small areas of poorly drained silty soils that are on terraces and at slightly higher elevation than this soil. These areas are seldom flooded, but water ponds on them in places. A few small areas are included that have a very firm subsoil.

Because of very frequent flooding, this soil is not suitable for cultivation. It is suitable for use as pasture or woodland. Capability unit VIw–86; woodland group 1w1.

Bucks Series

The Bucks series consists of deep, gently sloping to strongly sloping, well-drained soils that are underlain by red shale. These soils are on uplands.

In a representative profile the plow layer is dark-brown silt loam about 8 inches thick. The upper part of the subsoil is reddish-brown silt loam about 4 inches thick. The lower part is friable to slightly firm, yellowish-red or strong-brown, slightly heavier silt loam, about 20 inches thick. It is shaly in the lower part. The substratum is reddish-brown shaly loam about 12 inches thick. Red shale bedrock is at a depth of about 44 inches.

Permeability is moderate to moderately slow in the solum and moderately slow to moderately rapid in the underlying material. These soils have a high available water capacity. Natural fertility is moderate, and natural reaction is strongly acid. Crops on Bucks soils respond well to lime and fertilizer.

Most areas of Bucks soils have been cleared and are farmed. Control of erosion is needed in cultivated areas. The soils are well suited to corn, small grain, soybeans, nursery crops (fig. 6), pasture, and hay.

Representative profile of Bucks silt loam, 2 to 6 percent slopes, on the east side of Barley Sheaf Road, 1.5 miles east of Route 523:

Ap—0 to 8 inches, dark-brown (7.5YR 4/4) silt loam; weak, fine, granular structure; friable; few, soft, fine shale particles; medium acid; gradual, smooth boundary.

Figure 6.—**Nursery crops on Bucks silt loam, 2 to 6 percent slopes.**

B1—8 to 12 inches, reddish-brown (5YR 4/4) silt loam; weak, fine, subangular blocky structure; few soft, fine shale particles; medium acid; clear, smooth boundary.

B2t—12 to 22 inches, yellowish-red (5YR 4/6) silt loam; moderate, fine, subangular blocky structure; friable; few shale fragments in upper part of horizon, many in lower part; about 40 percent of ped faces have clay films on both vertical and horizontal surfaces; medium acid; gradual, smooth boundary.

B3—22 to 32 inches, strong-brown (7.5YR 5/8) silt loam; weak, fine, subangular blocky structure; slightly firm; 15 percent shale fragments; patchy clay films on ped faces; strongly acid; clear, smooth boundary.

C—32 to 44 inches, reddish-brown (5YR 4/4) shaly loam; friable; 30 percent shale fragments, increasing with depth; strongly acid; diffuse, smooth boundary.

R—44 inches, weathered, red shale bedrock.

Thickness of the silt loam mantle is variable, but the more shaly, lower part of the B horizon is at a depth of 2½ feet in most places. The solum ranges from 30 to 40 inches in thickness. Depth to hard bedrock ranges from 40 to 55 inches or more. Content of shale fragments in the upper part of the solum is as much as 5 percent but ranges from 10 to 30 percent in the lower part and in the C horizon. The Ap horizon has a hue ranging from 10YR to 5YR, a value of 4 or 5, and a chroma of 3 or 4. In the B horizon hue is 7.5YR to 2.5YR, value is 4 or 5, and chroma is 4 to 8. The texture is heavy loam, silt loam, or their shaly analogs. The C horizon ranges from 2.5YR to 7.5YR in hue, from 3 to 5 in value, and from 4 to 8 in chroma.

Bucks soils adjoin Penn, Readington, and Reaville soils and grade toward them. Bucks soils are deeper than the more shaly Penn soils. They lack the mottling that is characteristic of Readington and Reaville soils.

Bucks silt loam, 2 to 6 percent slopes (BuB).—This soil has the profile described as representative for the series. In about one-fourth of the areas there is a thin, slightly yellower, silty surface layer that is less than 20 inches thick. Another one-fourth has a redder surface layer that contains some shale fragments. The plow layer of this soil has a moderately high content of organic matter, and the soil is easy to till.

Included with this soil in mapping are small areas of nearly level soils. Also included are a few small areas of soils near Rosemont that have loam horizons containing more sand than those shown in the representative profile. Soils in these areas were derived from red sandstone. Other included areas of soils in the vicinity of Spring Mills, near the gneissic highlands in the northwestern part of the county, are underlain by mixed acid and calcareous sandy shale and some quartzite pebbles. The soil in these areas generally is loamy rather than silty, and the acidity decreases as depth increases. In these areas the soil is more easily worked and is a little more permeable than this soil.

Contour stripcropping is used on long slopes to reduce the hazards of runoff and erosion. Capability unit IIe–55; woodland group 2o1.

Bucks silt loam, 6 to 12 percent slopes, eroded (BuC2).—This soil has a profile similar to the one described as representative for the series, except that erosion has thinned the soil several inches, so that the slightly more clayey subsoil is mixed with the plow layer. In places the plow layer consists entirely of material from the subsoil. In places the subsoil is thinner and the bedrock is nearer the surface than is indicated in the representative profile. Gullies are common. Near Rosemont the soil is redder than in other areas and a little more sandy. It formed in red sandstone. The soil in about one-third of the area in the

northwestern part of the county near the gneissic highlands is more loamy and less silty. It becomes less acid near the sandy shale bedrock and is somewhat more permeable than the soil described as representative for this series.

Included with this soil in mapping are small areas where slopes are more than 12 percent and extensive areas that are not so eroded as this soil. Most of such areas are wooded.

The plow layer is low in content of organic matter and is more difficult to till than Buck soils that are not eroded. Runoff is rapid, and the erosion hazard is moderately severe. Cover crops, contour stripcropping, diversion terraces, and cropping systems that include sod can be used to reduce further erosion on these sloping soils. Capability unit IIIe–55; woodland group 2o1.

Califon Series

The Califon series consists of deep, nearly level to gently sloping, moderately well drained to somewhat poorly drained soils. They have a mottled clayey subsoil that is gravelly in places. These soils formed in gneissic glacial till or colluvium. They are on upland flats and concave slopes in the Highland section of the county.

In a representative profile the plow layer is dark-brown loam about 10 inches thick. The upper part of the subsoil is firm, strong-brown heavy loam or clay loam about 13 inches thick. The lower part is very firm, mottled, strong-brown, yellowish-brown, or yellowish-red loam about 27 inches thick. The substratum is yellowish-brown sandy loam.

The surface layer is moderately permeable, and the firm subsoil is slowly permeable. The substratum is moderately rapidly permeable. The available water capacity is high. Natural fertility is moderate, and natural reaction is strongly acid.

Most areas of Califon soils are wooded; small areas are cultivated. Control of erosion is needed on the gently sloping soils. In their natural state these soils dry slowly in spring. This is caused by a perched water table, lateral seepage, and the surface water that flows from surrounding slopes.

Wetness restricts crop growth and limits the use of this soil for growing alfalfa, small grain, and other similar crops. In undrained areas these soils are used for pasture or hay.

Representative profile of Califon loam, 0 to 3 percent slopes, in an idle field, 0.25 mile east of Van Syckel crossroads:

Ap—0 to 10 inches, dark-brown (10YR 4/3) loam; weak, fine, subangular blocky structure; firm; many fine roots; 2 percent hard granite, quartzite, and chert pebbles; medium acid; clear, smooth boundary.

B1—10 to 16 inches, strong-brown (7.5YR 5/6) heavy loam; weak, medium, subangular blocky structure; firm, hard when dry; many fine roots; 2 percent hard granite quartzite and chert fragments; old wormholes and large root cavities filled with Ap horizon material; medium acid; gradual, smooth boundary.

B2t—16 to 23 inches, strong-brown (7.5YR 5/6) clay loam, few, fine, distinct, brown (10YR 5/3) mottles; weak, medium, subangular blocky structure; firm, very hard when dry; few fine roots; common medium and fine pores; 10 percent subangular fragments of granite; quartzite, and chert 1 to 2 inches in diameter; distinct, dull clay films on ped faces and in pores; strongly acid; clear, smooth boundary.

Bx1—23 to 28 inches, strong-brown (7.5YR 5/6) loam; many, medium, prominent, yellowish-brown (10YR 5/4) and strong-brown (10YR 5/8) mottles; very pale brown (10YR 7/3) coatings on major ped faces; weak, coarse, prismatic structure parting to moderate, thick, platy; very firm, very hard when dry; few fine roots; few fine pores; 10 percent strongly weathered granitic fragments 1 to 2 inches in diameter; thin dull coats on ped faces; common black (N 2/0) manganese and iron coatings; strongly acid; gradual, smooth boundary.

Bx2—28 to 33 inches, yellowish-brown (10YR 5/4) heavy loam; few medium and many fine, faint, strong-brown (7.5YR 5/6) mottles; moderate, medium, platy structure; very firm, hard when dry; no roots; many fine pores; 10 percent strongly weathered granitic fragments; thin, glossy clay films on vertical and horizontal surfaces; very strongly acid; gradual, smooth boundary.

Bx3—33 to 43 inches, heavy loam, prominently mottled with equal amounts of yellowish red (5YR 5/6), strong brown (7.5YR 5/6), and gray (5YR 5/1); moderate, thick, platy structure; very firm; no roots; few fine pores; dull coatings on horizontal surfaces; 10 percent strongly weathered granitic fragments; very strongly acid; abrupt, smooth boundary.

Bx4—43 to 50 inches, strong-brown (7.5YR 5/6) heavy loam; common, medium, distinct, light brownish-gray (10YR 6/2) mottles; very weak, thick, platy structure; very firm; few fine pores; 10 percent strongly weathered granite gneiss fragments; stones and boulders present; discontinuous glossy coatings on ped faces; common clay pockets; very strongly acid; clear, smooth boundary.

C—50 to 75 inches, yellowish-brown (10YR 5/8) sandy loam; yellowish-red (5YR 5/8) and very pale brown (10YR 7/3) bands; massive; friable; many, fine, sharp fragments; black coatings (N 1/0) in places; strongly acid.

The solum is 40 to 60 inches in thickness. Depth to the fragipan is 20 to 30 inches. Depth to bedrock is 6 to 20 feet. Coarse fragments occur throughout the profile, ranging in content from 2 to 25 percent. Granite gneiss, quartz, quartzite, and chert are the principal rock materials in the soils.

In the surface layer the color ranges from 10YR 4/2 to 5/4. The B and Bx horizons range from 7.5YR to 10YR in hue. They have a value of 5 and a chroma of 6 to 8. The texture is heavy loam, heavy silt loam, silty clay loam, and clay loam. The C horizon has a hue ranging from 7.5YR to 5Y, a value of 5 or 6, and a chroma of 3 to 6. Mottling in this soil ranges from faint to prominent as the depth increases. Low-chroma mottling is confined to the lower part of the B horizon and to the C horizon.

Most of the fine-textured material was weathered from decayed feldspars, amphiboles, and other gneissic minerals. Stones are common throughout the soils and one very stony phase is mapped.

In a few places where the limestone component of the till is more abundant than is normal for those soils, reaction is less acid.

Califon soils adjoin Cokesbury, Annandale, Parker, and Edneyville soils and grade toward them. They have a browner A horizon and are less gray throughout the profile than the poorly drained Cokesbury soils. Mottling in the B horizon distinguishes Califon soils from the well-drained, unmottled Annandale, Parker, and Edneyville soils.

Califon loam, 0 to 3 percent slopes (CaA).—This soil has the profile described as representative for the series. In places the surface layer is several inches thicker than the one described as representative for the series because of deposits washed from the surrounding slopes. Typically, the content of coarse fragments in this soil averages less than 15 percent. In many small areas the plow layer is as much as 15 or 20 percent gravel. Scattered stones are common in places, especially in wooded areas.

Small poorly drained spots where gray colors dominate are included with this soil in mapping. Other small inclusions are soils that have the coarser textured substratum within a depth of 40 inches. Such spots are more easily drained.

Runoff is slow, and the restricted drainage in the subsoil causes a moderately high seasonal water table.

Because wetness is a major limitation, bedding has been used on nearly level cultivated areas to dispose of surface water. Graded stripcropping, supplemented by diversion terraces and grassed waterways, is helpful in mangaging the excess water. In places low spots can be drained by using tile. Capability unit IIw–71; woodland group 2w1.

Califon loam, 3 to 8 percent slopes (CaB).—This soil has a profile similar to the one described as representative for the series, except that in areas on some concave slopes and seepage spots, gray mottling is closer to the surface. Typically, the content of coarse fragments averages less than 15 percent, but in many areas the content is as much as 20 percent in the plow layer. Scattered stones are common in places, especially in woodlots.

Included with this soil in mapping are small areas where slopes are greater than 8 percent and a few areas where there is a moderately coarse textured substratum weathered from rock. In such areas the soils are more easily drained than this soil. A few areas are also included where the soil is eroded, and the plow layer is partly material from the subsoil.

A moderately high seasonal water table and excessive runoff result from impeded drainage in the subsoil. In addition, the runoff causes an erosion hazard. Suitable crops are corn, small grain, pasture, and mixed hay. In cultivated areas graded stripcropping supplemented by diversion terraces and grassed waterways can be used to reduce runoff and to control erosion. Open ditches can be used to dispose of surface water. Capability unit IIe–71; woodland group 2w1.

Califon very stony loam, 0 to 8 percent slopes (CbB).—This soil has more stones and boulders on the surface and throughout the profile than the soil described as representative for the series. Stones and boulders of gneiss are 3 to 30 feet apart on the surface. Between the stones the soil is similar to Califon loam, but it generally is more than 15 percent gravel. Included in mapping are a few small areas of very similar soil in which coarse fragments are almost entirely quartzite. Most of such areas are wooded. Also included are many areas of seeps and areas of soils that have gray mottling closer to the surface than is normal for the series.

The high content of stones makes the growing of intertilled crops impractical. Open drainage ditches can be used to remove excess surface water. Capability unit VIs–75; woodland group 2w1.

Chalfont Series

The Chalfont series consists of deep, nearly level to strongly sloping, somewhat poorly drained, loamy soils that have a fragipan in the lower part of the subsoil.

In a representative profile, in a wooded area, the surface layer is brown silt loam, and the subsurface layer is brownish-yellow silt loam. The two layers combined are about 9 inches thick. The upper part is slightly firm, mottled, yellowish-brown silt loam about 7 inches thick. The middle part is firm, mottled, brown silty clay loam about 10 inches thick. The lower part of the subsoil is a very firm, mottled, reddish-brown silty clay loam fragipan about 16 inches thick. The substratum is gray silt loam about 8 inches thick. Hard, dark-gray bedrock is at a depth of 50 inches.

Permeability is moderate in the surface layer and slow in the subsoil and substratum. In places water flows laterally over the firm fragipan. Available water capacity is high, but only the water above the firm layer is available to plants because roots do not penetrate the firm subsoil. Natural fertility is moderate. Natural reaction ranges from medium acid to strongly acid, but limed fields are less acid.

Large areas of these soils are idle and are reverting to brush or trees. The soils contain excess water in winter and late in spring. If these soils are drained, they are suited to corn, soybeans, grain, hay, or pasture.

Representative profile of Chalfont silt loam, 0 to 2 percent slopes, in a wooded area, on the south side of road to Locktown, 0.4 mile east of Route 579.

A1—0 to 4 inches, brown (10YR/3) silt loam; weak, fine, granular structure; friable; many roots; strongly acid; clear, smooth boundary.

A2—4 to 9 inches, brownish-yellow (10YR 6/6) silt loam; very weak, fine, subangular blocky structure; friable; many roots; strongly acid; clear, smooth boundary.

B1—9 to 16 inches, yellowish-brown (10YR 5/4) silt loam; common, medium, distinct, strong-brown (7.5YR 5/6) mottles; moderate, medium, subangular blocky structure; slightly firm; many roots; discontinuous thin clay films on ped faces; strongly acid; gradual, wavy boundary.

B2t—16 to 26 inches, brown (7.5YR 5/4) silty clay loam; many medium, distinct, strong-brown (7.5YR 5/8) and pinkish-gray (7.5YR 6/2) mottles; strong, medium, platy structure; firm; few roots; thick continuous clay films on ped faces; strongly acid; clear, wavy boundary.

Bx—26 to 42 inches, reddish-brown (5YR 4/3) silty clay loam; common, medium, faint, reddish-gray (5YR 5/2) mottles; moderate, medium and coarse, prismatic structure parting to very strong, thin, platy; extremely firm, brittle; 10 percent coarse fragments; many black iron concretions; thin discontinuous clay films on horizontal faces of peds and fragments; medium acid; clear, wavy boundary.

C—42 to 50 inches, gray (N 5/0) very channery silt loam; 60 percent coarse, channery fragments; firm; medium acid; gradual boundary.

R—50 inches, dark-gray argillite bedrock; massive hard.

The solum ranges from 40 to 60 inches in thickness. Depth to the fragipan ranges from 15 to 30 inches, and depth to bedrock ranges from 3½ to 6 feet or more. Coarse fragments range from 0 to 10 percent in the surface layer and upper part of the solum, and from 15 to 60 percent in the lower part of the fragipan. They make up as much as 60 percent of the C horizon. In cultivated areas the Ap horizon is 10YR in hue, 3 or 4 in value, and 2 or 3 in chroma. The B horizon is 10YR to 5YR in hue, 4 or 5 in value, and 2 to 8 in chroma. Faint mottling begins at a depth below 9 inches, and gray mottling below a depth of 16 inches. In places thin, silty deposits, possibly of eolian origin, are on the surface.

Chalfont soils adjoin Croton and Lawrenceville soils and grade toward them. They are not so gray as the poorly drained Croton soils. Chalfont soils have mottles of low chroma higher in the profile than Lawrenceville soils.

Chalfont silt loam, 0 to 2 percent slopes (CdA).—This nearly level soil has the profile described as representative for the series. Included in mapping are small areas where the soil has a pan that is weakly or moderately developed and a few small areas of the more poorly drained Croton soils in low spots.

Wetness is the major limitation to farm use of this soil, and the firm subsoil is another limitation. This soil is well suited to mixed hay and pasture. It is only fairly well suited to corn and small grain. Grasses and legumes that tolerate wetness can be used for hay and pasture. Open ditches can be used to reduce the difficulties caused by excess water. Diversion of water that flows from steeper slopes helps to reduce the need for draining. Capability unit IIIw–70; woodland group 3w1.

Chalfont silt loam, 2 to 6 percent slopes (CdB).—This soil has a profile similar to the one described as representative for the series. In many places, however, the fragipan is not so firm as the fragipan in that soil.

Included with this soil in mapping are many areas where the surface layer is channery silt loam. Also included are small areas of well-drained Quakertown soils, a few areas of poorly drained Croton soils, many areas of soils that have gray mottles at a depth of more than 24 inches, and a few areas where bedrock is at a depth of 3 feet or less. In places in cultivated areas, erosion has removed several inches of the surface layer; and in places shallow gullies cut the areas. In these areas the content of organic matter is lower than in this soil. The same crops can be grown, but more intensive conservation measures generally are needed.

The major limitation for crops is wetness caused by the slow permeability of the fragipan in the subsoil. Legumes and grasses that tolerate wetness are well suited. They can be grown for hay and pasture. Open ditches and diversions can be used to remove excess surface water if corn or small grain is grown. Capability unit IIIw–70; woodland group 3w1.

Chalfont silt loam, 6 to 12 percent slopes, eroded (CdC2).—This soil has a profile similar to the one described as representative for the series, except that erosion has thinned the surface layer, and material from the more clayey subsoil has been mixed into the plow layer. Also, the fragipan is closer to the surface. In places shallow gullies are common in fields. In many places gullying has been severe, and erosion has exposed the pan at the surface. Seeps are common. Runoff is rapid, and the hazard of further erosion is moderately severe.

Included with this soil in mapping are areas of less eroded soils. Some of these included soils are under trees. Also included are a few areas of moderately steep soils, a few areas where rock crops out, and areas where bedrock is at a depth of 2 to 3 feet. In addition, small areas of soils are included that are better drained and are deeper to gray mottles. In many such areas the pan is not so strongly developed as that in this soil.

Fertility and content of organic matter are harder to maintain in this Chalfont soil than in less eroded Chalfont soils. An accumulation of flat, angular, coarse fragments is on the surface in many eroded areas. These fragments serve as a mulch; and, if left undisturbed, they help to reduce sheet erosion. Capability unit IIIe–70; woodland group 3w1.

Chalfont very stony silt loam, 2 to 12 percent slopes (CeB).—This soil has a profile similar to the one described as representative for the series, except that stones and boulders 3 to 30 feet apart are on the surface and are scattered throughout the profile. Runoff is moderate, and the hazard of erosion is slight. Included in mapping are a few areas of wet Croton soils.

Nearly all areas of this soil are wooded. The soil is too stony to cultivate. Unless the stones are removed, this soil is suited only to pasture or trees. Capability unit VIs–75; woodland group 3w1.

Chalfont-Lehigh very stony silt loams, 2 to 12 percent slopes (CfC).—This mapping unit is about 60 percent Chalfont very stony silt loam, 35 percent Lehigh very stony silt loam, and about 5 percent Croton and Lawrenceville soils. The Chalfont and Lehigh soils have profiles similar to the ones described as representative for their series, except that stones larger than 10 inches in diameter are about 3 to 30 feet apart on the surface. These soils are under trees on Sourland Mountain. They are next to Neshaminy soils that are on intrusive diabase ridges.

Included with these soils in mapping are a few areas of better drained soils. Also included are several areas of rock outcrops that are more steeply sloping than these soils.

These soils are slowly permeable in the lower part of the subsoil and have a seasonal moderately high water table. They warm slowly and remain wet until late in spring. Stoniness and gentle to strong slopes further limit use of these soils for trees or water-tolerant pasture. Capability unit VIs–75; woodland group 3w1.

Chalfont-Quakertown silt loams, 0 to 6 percent slopes (CgB).—Each of the two soils in this mapping unit has a profile similar to that described as representative for its respective series. These soils are along the eastern and southern borders of the Hunterdon Plateau, northwest of the town of Flemington. The Chalfont soil makes up about 60 to 70 percent of this mapping unit and is mainly in lower positions in the landscape. The Quakertown soil occupies higher positions and is better drained. About 5 percent of the mapped areas is poorly drained Croton soils. In a few places the soils are eroded and cut by gullies, and the plow layer consists partly of material from the subsoil. The relief of the mapped areas is generally complex and without pattern.

The Quakertown soil has few limitations to use, but in places the Chalfont soil has limitations that control the timing of field operations. A moderately high water table in the Chalfont soil keeps the surface wet and prevents the use of machinery for several days after the Quakertown soil is ready to plow. Open ditches can be used to remove excess water in the Chalfont soils. Capability unit IIIw–70; woodland group 3w1.

Cokesbury Series

The Cokesbury series consists of deep, nearly level to gently sloping, poorly drained, loamy soils that formed in material weathered from gneissic rock.

In a representative profile the plow layer is very dark grayish-brown loam about 9 inches thick. The subsurface layer, about 10 inches thick, is grayish-brown sandy loam that is distinctly mottled. The upper part of the subsoil, about 9 inches thick, is gray friable sandy clay loam that is distinctly mottled. The lower part of the subsoil is a very firm, distinctly mottled, olive-brown loam fragipan about 12 inches thick. The substratum is distinctly mottled, pale-brown loam.

Cokesbury soils are slowly permeable in the fragipan. Available water capacity is high, natural fertility is moderate, and natural reaction is medium acid or strongly acid.

Most areas of Cokesbury soils are wooded. Excess water in the soil is the main concern if the soils are farmed. Drainage is needed if these soils are to be used for tilled crops, hay, or pasture.

Representative profile of Cokesbury loam, in a wooded area south of Wilson Avenue, 0.5 mile west of Petticoat Lane:

Ap—0 to 9 inches, very dark grayish-brown (2.5Y 3/2) loam; weak, medium, platy structure; friable; many medium and fine roots; 5 percent coarse fragments; strongly acid; clear, smooth boundary.

A2g—9 to 19 inches, grayish-brown (10YR 5/2) sandy loam; common, medium, distinct, dark yellowish-brown (10YR 4/4) mottles; weak, medium, subangular blocky structure; friable; few medium and coarse roots; thin discontinuous clay coats on ped faces; 5 percent coarse fragments; medium acid; clear, smooth boundary.

B2tg—19 to 28 inches, gray (5Y 5/1) sandy clay loam; common, medium, distinct, olive-brown (2.5Y 4/4) mottles; moderate, fine, subangular blocky structure; friable; thick continuous clay coatings on ped faces; 5 percent coarse fragments; strongly acid; abrupt, smooth boundary.

Bx—28 to 40 inches, olive-brown (2.5Y 4/4) heavy loam; common, medium, distinct, gray (5Y 5/1) and yellowish-brown (10YR 5/6) mottles; weak, coarse, prismatic structure; very firm; thin patchy clay films on ped faces; 25 percent coarse fragments consisting of pebbles, cobblestones, and stones; strongly acid; gradual, wavy boundary.

C—40 to 60 inches, pale-brown (10YR 6/3) loam; common, coarse, prominent, yellowish-brown (10YR 5/6) and light-gray (2.5Y 7/2) mottles; massive; friable; 30 percent coarse fragments; very strongly acid.

The solum ranges from 26 to 40 inches in thickness. Depth to gneissic bedrock is more than 6 feet, but in places it is much greater. Depth to the top of the pan ranges from 20 to 30 inches. The A horizon is 5 to 20 percent coarse fragments, in the B horizon 5 to 25 percent, and the C horizon 30 to 50 percent. Stones generally are throughout the profile, but they are much more numerous in the C horizon.

The A horizon has a hue ranging from 2.5Y to 10YR, a value of 3 to 5, and a chroma of 1 or 2. The B2t and Bx horizons have a hue of 10YR, 2.5Y, or 5Y; a value of 4 or 5; and a chroma of 1 to 6. Low chromas dominate to a depth of at least 2 feet. The B2t and Bx horizons are heavy loam, sandy clay loam, and clay loam.

The C horizon has a matrix hue of 10YR, 2.5Y, and 5Y; a value of 4 to 6; and a chroma of 3 to 7. Mottles have a value of 2 to 7 and a chroma of 2 to 6. The texture is loam or sandy loam that has a high percentage of gravel and stones.

Cokesbury soils adjoin Califon soils and grade toward them. They have a darker A horizon and a grayer B horizon than the Califon soils.

Cokesbury loam (Co).—This soil has the profile described as representative for the series. Slopes range from 0 to 4 percent.

Included with this soil in mapping are small areas of very poorly drained soils that have a thick, very dark surface layer. Also included are areas of soils without a fragipan, areas in which the low chromas are not dominant immediately below the plow layer, and some areas of gravelly or very stony soils. The gravelly and very stony soils are less suited to farming than this soil. Small seepage areas of more sloping soils are also included at the base of steep slopes.

Wetness is a major limitation if the soil is farmed. Open drains can be used to dispose of excess water. If the soil is adequately drained, corn and small grain can be grown; if drainage is not provided, hay or pasture is more suitable. Capability unit IVw–82; woodland group 3w1.

Cokesbury very stony loam (Cp).—This soil has many stones and boulders on the surface and throughout the profile; otherwise it has a profile similar to the one described as representative for the series. Stones, boulders, and fragments of gneiss are about 3 to 30 feet apart and so numerous that tillage is not practical (fig. 7).

Included with this soil in mapping are a few small areas of very poorly drained soils that have a thick, dark surface layer. Also included are many areas where the fragipan is either weak, thin, or lacking and a few areas of a more sloping soil at the base of steeper slopes.

Most areas are wooded, but in places they are cleared for farming. Stoniness and wetness are major limitations to farming and to many other uses. Open drains are used to remove excess water. Capability unit VIIs–77; woodland group 3w1.

Croton Series

The Croton series consists of deep, nearly level to gently sloping, poorly drained soils. They formed in material weathered from very hard, massive argillite rock.

In a representative profile the plow layer is dark grayish-brown silt loam 9 inches thick. The upper part of the subsoil, which is about 9 inches thick, is very firm and distinctly mottled gray silty clay loam. The lower part is a very firm and brittle, gray fragipan of silt loam about 18 inches thick. It is mottled light brownish gray and yellowish brown. The substratum is very firm yellowish-brown silty clay loam 12 inches thick. It also has a fragipan. Red shattered shale bedrock is below a depth of 48 inches.

In Croton soils the surface layer is moderately permeable, and the subsoil is slowly permeable. The available water capacity is high. Natural fertility is moderate, and natural reaction is medium acid or strongly acid. Limed fields are not so acid. Excess water in these soils is the main limitation to farming. Drainage is needed if these soils are to be used to grow corn, wheat, hay, or pasture. Grasses and legumes that tolerate wetness can be grown.

Representative profile of Croton silt loam, 0 to 2 percent slopes, under cultivation, 1 mile north of Locktown:

Ap—0 to 9 inches, dark grayish-brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) when dry; weak, fine,

Figure 7.—**Cokesbury very stony loam used for permanent pasture.**

granular structure; friable; slightly sticky and slightly plastic; many roots; medium acid; clear, smooth boundary.

B2tg—9 to 18 inches, gray (N 5/0) silty clay loam; many distinct mottles of gray (10YR 5/1) and strong brown (7.5YR 5/6) in interiors of peds; moderate, medium, prismatic structure parting to weak, medium, platy; very firm, plastic; few fine roots; clay films in voids; very strongly acid; clear, smooth boundary.

Bxg—18 to 36 inches, light brownish-gray (10YR 6/2) and yellowish-brown (10YR 5/6) silty clay loam; interiors of peds are strong brown (7.5YR 5/6) and have many, medium and coarse, gray (N 4/0) mottles; moderate, medium, platy structure; very firm, brittle; few roots in cracks; thin clay films on faces of peds and in voids; 10 percent fine fragments consisting of shale and sandstone; strongly acid; gradual, smooth boundary.

Cx—36 to 48 inches, yellowish-brown (10YR 5/4) light silty clay loam; massive; very firm; 15 percent fragments consisting of very fine grained silty sandstone; strongly acid to medium acid; abrupt, smooth boundary.

R—48 inches, red (10R 4/6) shattered shale.

The solum, including the upper part of the fragipan, ranges from 28 to 40 inches in thickness. Depth to bedrock ranges from 3½ to 5 feet; depth to the fragipan ranges from 15 to 20 inches.

In the Ap horizon the hue ranges from 10YR to 7.5YR, value is 3 or 4, and chroma ranges from 2 to 4. The B2t horizon has a hue of 10YR or 7.5YR to 5YR, a value of 5, and a chroma of 0 to 2. Texture is heavy silt loam and silty clay loam. The Bx horizon ranges from 5YR to 10YR in hue, from 4 to 6 in value, and from 0 to 2 in value. The texture is light silty clay loam or heavy silt loam, and the content of coarse fragments ranges from 0 to 20 percent.

Croton soils adjoin Chalfont soils and grade toward them. The poorly drained Croton soils occupy low positions where the water table, except in summer, is high. They are grayer than the Chalfont soils.

Croton silt loam, 0 to 2 percent slopes (CrA).—This soil has the profile described as representative for the series. It remains wet until late in spring and warms very slowly.

Included with this unit in mapping are many small areas of better drained Chalfont soils and a few small areas of wetter, darker, surface soils in low positions that are subject to ponding.

This soil is better suited to pasture, hay, or trees than to tilled crops. Drainage is necessary for tilled crops and beneficial to hay and pasture crops. Grasses and clovers that tolerate wetness can be grown. Open ditches can be used to provide drainage. Tile drains generally are unsatisfactory because of the slow internal drainage. Bedding may be needed in places to speed up surface drainage. Capability unit IVw–80; woodland group 3w1.

Croton silt loam, 2 to 6 percent slopes (CrB).—This soil is similar to the one described as representative for the series, except that it is more sloping and has better surface drainage. It does have hillside seepage, however. Wetness is the principal limitation to growing crops, but the depth of the rooting zone is also a limitation.

Included with this unit in mapping are a few small areas where erosion has removed most of the original surface layer. Also included, in places, are areas that are gullied. In addition, about 10 percent of the mapped areas have slopes of more than 6 percent; and in a few places scattered, massive rock outcrops impede fieldwork.

This soil is best suited to hay, pasture, or trees; but tilled crops can be grown if adequate drainage is provided.

Bedding, graded strips, and diversion terraces can be used to provide drainage. Capability unit IVw–80; woodland group 3w1.

Croton very stony silt loam, 0 to 6 percent slopes (CsB).—This soil has a profile similar to that described as representative for the series, except that stones larger than 10 inches and 3 to 30 feet apart are scattered on the surface and throughout the profile. In wooded areas thin dark layers of organic matter are on the surface.

Included with this unit in mapping are very small areas of more sloping soil. Seeps are prominent in these areas.

Stones and wetness severely limit the use of this soil for tilled crops. The soils are mainly in pasture grasses that tolerate wetness. Capability unit VIIs–77; woodland group 3w1.

Duffield Series

The Duffield series consists of deep, gently sloping to moderately steep, well-drained soils that formed over limestone or limey shale. These soils have many shallow depressions and a few moderately deep, closed depressions.

In a representative profile the plow layer is dark-brown silt loam 9 inches thick. The upper 5 inches of the subsoil is friable, dark yellowish-brown silt loam. The lower part is friable, yellowish-brown heavy silt loam about 28 inches thick. The substratum is gray loam that is 70 percent limestone fragments. Hard, dark-gray limestone is at a depth of about 56 inches.

Duffield soils have moderate permeability throughout their profiles. Available water capacity is high, natural fertility is high, and natural reaction is neutral to medium acid.

Most Duffield soils have been cleared for farming. Control of erosion is needed. Large areas are used for pasture, hay, corn, and small grain. Alfalfa can be grown as a hay crop. Truck farming is extensive in the Musconetcong valley (fig. 8).

Representative profile of Duffield silt loam, 2 to 6 percent slopes, in a pasture along the south side of Valley Road, 1.1 miles west of Main Street in Hampton:

Ap—0 to 9 inches, dark-brown (10YR 3/3) silt loam; weak, fine, granular structure; friable; many fine roots; 2 percent angular limestone pebbles; slightly acid; clear, smooth boundary.

Figure 8.—**Cabbage on Duffield silt loam, 0 to 2 percent slopes.**

B1—9 to 14 inches, dark yellowish-brown (10YR 4/4) silt loam; moderate, medium, granular structure; friable; many fine and medium roots; 2 percent angular limestone pebbles; neutral; clear, smooth boundary.

B21t—14 to 28 inches, yellowish-brown (10YR 5/8) heavy silt loam; moderate, medium, subangular blocky structure; friable; few roots; thin discontinuous clay films on most ped faces; neutral; clear, irregular boundary.

B22t—28 to 42 inches, yellowish-brown (10YR 5/8) heavy silt loam; moderate, fine, subangular blocky structure; friable; 10 percent soft, fine, limey shale fragments; thin slightly darker clay films on peds; slightly acid; gradual, wavy boundary.

C—42 to 56 inches, gray (5Y 5/1) loam; structure masked by 70 percent weathered limestone fragments; firm; few black coatings; medium acid; clear, irregular boundary.

R—56 inches, dark-gray, hard limestone and limey shale bedrock.

The solum ranges from 42 to 60 inches or more in thickness. Depth to bedrock ranges from 4 to 7 feet. Coarse fragments generally make up less than 10 percent of the upper part of the solum, 5 to 25 percent of the lower part, and 35 to 80 percent of the C horizon.

In the Ap horizon the hue is 10YR or 7.5YR, value is 3 or 4, and chroma ranges from 2 to 4. The B horizon ranges from 10YR to 7.5YR in hue, has a value of 4 to 6, and ranges from 4 to 8 in chroma. Texture ranges from heavy silt loam to silty clay loam. The C horizon ranges from 5Y to 5YR in hue, has a value of 4 or 5, and ranges from 1 to 6 in chroma.

Duffield soils adjoin Berks, Bedington, Washington, Annandale, Turbotville, and Edneyville soils. They are deeper and less shaly than Berks soils and less shaly than Bedington soils. They contain less gravel than Washington soils. Duffield soils lack the fragipan and gravel that is characteristic of Annandale soils. They lack mottling that occurs in Turbotville soils, and they have fewer coarse fragments than Annandale soils.

Duffield silt loam, 2 to 6 percent slopes (DuB).—This soil has the profile described as representative for the series. Included in mapping are small areas of soils that have slopes of 0 to 2 percent and areas of eroded soils. In the areas of eroded soils, the plow layer is mixed with a slightly more clayey material from the subsoil.

This soil is farmed intensively. It is well suited to vegetables and other general farm crops commonly grown in the county. Simple management practices can be used to overcome the slight hazard of erosion. In cultivated areas stripcropping is used to reduce the amount of runoff and erosion.

In many areas gneissic coarse fragments are in the upper 20 inches of the soil. Shallow, closed depressions and occasional sinkholes are limitations to nearly every use of such areas. New sinkholes are likely to open up after wet periods or prolonged saturation. Danger of ground water contamination is a constant concern. Capability unit IIe–54; woodland group 1o1.

Duffield silt loam, 6 to 12 percent slopes, eroded (DuC2).—This soil has a profile similar to the one described as representative for the series, except that erosion has thinned the original soil so that heavier subsoil material is mixed in with the plow layer. Shallow gullies are common.

Included with this soil in mapping are small areas where the soil is not eroded and a few areas of soils that have a shaly silt loam surface layer and are less than 3½ feet deep over bedrock.

If well managed, this soil will absorb most of the rainwater and store a large amount of it for plant use. The plow layer is lower in content of organic matter than the less eroded Duffield soils, and it is more difficult to work. Runoff is rapid, and the erosion hazard is moderately severe. Cover crops, contour stripcropping, diversion terraces, and cropping systems that include sod can be used to reduce the hazard of further erosion on these slopes. Capability unit IIIe–54; woodland group 1o1.

Duffield rocky silt loam, 6 to 12 percent slopes, eroded (DvC2).—The soil between the rock outcrop has a profile similar to the one described as representative for the series, except that in narrow fringes around the outcrop it is less than 3½ feet deep over bedrock and has a shaly silt loam texture. Outcrops on an average are 100 to 300 feet apart, about 25 feet in width, and 50 to 100 feet or more in length. They cover 2 to 10 percent of the surface area. The rocks are massive dark-gray limestone. Erosion has thinned the soil so that heavier material from the subsoil is mixed with the plow layer.

Included with this soil in mapping are small areas of red soil that has red, calcareous, conglomerate outcrops and wooded areas where the soil is not eroded.

Runoff is rapid, and the erosion hazard is moderately severe. The soil has a high available water capacity. Because of the rocks, permanent pasture is the common use. Some areas of soils are in crops under a regular cropping system. Capability unit IVe–55; woodland group 1o1.

Duffield very rocky silt loam, 12 to 18 percent slopes, eroded (DwD2).—This soil is similar to the one described as representative for the series, except that rock outcrops are about 30 to 100 feet apart.

Included with this soil in mapping are small areas of soils that slope more than 18 percent and a few small areas of steep soils. In some areas the soil is less than 20 inches deep over rock.

Rocks and outcropping of rock ledges are sufficiently numerous to make cultivation difficult. This soil is better suited to improved pasture than to other uses. Reseeding to improve pasture is feasible. Slopes can be worked on the contour to prevent further erosion. Capability unit VIs–61; woodland group 1x1.

Edneyville Series

The Edneyville series consists of deep, gently sloping to steep, well-drained, gravelly soils that formed over granite gneiss bedrock.

In a representative profile the surface layer is dark-brown gravelly loam about 13 inches thick. The subsoil is friable, yellowish-brown sandy clay loam about 15 inches thick. It is 10 percent 1- to 4-inch angular gravel and cobblestones. The substratum is friable, brownish-yellow gravelly sandy loam that is 30 percent or more of 1- to 6-inch rock fragments. The number and size of the fragments increase with depth. Bedrock is at a depth of about 42 inches.

Edneyville soils are moderately permeable. The substratum is moderately permeable or moderately rapidly permeable. Available water capacity is moderate, and fertility is moderate. Natural reaction is strongly acid, but limed fields are not so acid.

Most Edneyville soils originally contained many stones and rocks (fig. 9), but extensive areas have been cleared for farming. Erosion control is needed. On the lesser slopes

Figure 9.—Typical field of Edneyville gravelly loam.

corn, soybeans, small grain, apples, hay, and pasture are suited.

Representative profile of Edneyville gravelly loam, 3 to 8 percent slopes, in a cultivated area near the intersection of Mount Airy and Red Mill roads, 1.5 miles northeast of Glen Gardner:

Ap—0 to 13 inches, dark-brown (10YR 4/3) gravelly loam; moderate, fine and medium, granular structure; friable; 20 percent angular gneiss gravel; medium acid; clear, smooth boundary.

Bt—13 to 28 inches, yellowish-brown (10YR 5/4) sandy clay loam; moderate, medium, subangular blocky structure; friable; thin continuous clay films on ped faces; 10 percent angular gneiss gravel and cobblestones; strongly acid; gradual, smooth boundary.

C—28 to 42 inches, brownish-yellow (10YR 6/6) gravelly sandy loam; weak, fine, subangular blocky structure; friable; 30 percent angular gneiss gravel and cobblestones; strongly acid.

R—42 inches, gneiss bedrock.

The solum ranges from 20 to 40 inches in thickness. Depth to bedrock ranges from 3½ to 6 feet. Angular, gneissic, coarse fragments make up as much as 35 percent of the A and B horizons. In the Ap horizons color has a hue of 10YR, a value of 4 or 5, and a chroma of 2 to 5. In the B horizon the hue is 10YR or 7.5YR, value is 4 or 5, and chroma is 3 to 6. Texture of the B horizon generally is sandy clay loam, clay loam, or heavy loam. In the C horizon color has a hue of 10YR, a value of 5 or 6, and a chroma of 4 to 6. Texture of the C horizon generally is sandy loam; but it is sandy clay loam, heavy loam, or clay loam in places. Generally the gravel in the saprolite is mostly fine.

Edneyville soils adjoin Annandale and Parker soils and grade toward them. Edneyville soils have more clay in the B horizon and are much less cobbly than Parker soils. They have less clay in the B horizon than Annandale soils, and they lack the fragipan of these soils.

Edneyville gravelly loam, 3 to 8 percent slopes (EdB).—This soil has the profile described as representative for the series. Included in mapping are small areas of soils where slope is 0 to 3 percent or 8 to 15 percent, a few areas of soils with a subsoil of firm clay loam that extends to a depth of more than 40 inches and is moderately slowly permeable, and cultivated areas of eroded soil that has a lower content of organic matter than this soil. Also included are small areas of very cobbly or very stony soils; areas of Parker very gravelly loam; and a few areas, especially where seepage is present, of moderately well drained or somewhat poorly drained soil that is mottled. In addition, a few areas of soils similar to this one, except that they contain fragments of mainly quartzite, are included near Round Valley Reservoir and the town of Annandale.

This soil is suited to corn, small grain, and grasses; and it is well suited to apple orchards. Stripcropping is used to reduce the hazard of erosion on longer slopes. Capability unit IIe–58; woodland group 2o1.

Edneyville gravelly loam, 8 to 15 percent slopes, eroded (EdC2).—This soil has a profile similar to the one described as representative for the series, except that erosion has thinned the original surface layer several inches, and material from the more clayey subsoil is mixed with that of the plow layer. In a few areas the subsoil is exposed. Gullies are common.

Included with this soil in mapping are extensive areas of soil that is less eroded than this soil. Most of these areas are wooded and have not been farmed. A number of small areas of Parker soils also have been mapped with this soil. Most of them are cropland or idle fields. In the vicinity of Annandale and Round Valley Reservoir, areas of similar soils, derived largely from quartzite, are also included.

Runoff is rapid, and the erosion hazard is moderately severe. Content of organic matter is low and is hard to maintain. The soil is a little more droughty than the less eroded Edneyville soils.

This soil is suited to the general crops grown in the county. Cover crops, contour stripcropping, diversion terraces, and cropping systems that include sod are used to reduce the amount of erosion. Capability unit IIIe–58; woodland group 2o1.

Edneyville gravelly loam, 15 to 25 percent slopes (EdD).—Many small areas of this soil are stony. The erosion hazard is severe. Small areas of severely eroded soil, some cut by shallow gullies, are included in mapping. Also included are small areas of soils that slope more than 25 percent and areas of Parker soils.

This unit is about equally divided between cultivated and wooded areas. Severe erodibility, rapid runoff, and steepness limit the use of this soil for farming and many other uses. It is not suited to continuous row crops. It is better suited to hay, pasture, trees, or wildlife habitat. Capability unit IVe–58; woodland group 2r1.

Edneyville and Parker extremely stony loams, 3 to 15 percent slopes (EeC).—This mapping unit consists of Edneyville and Parker soils in wooded areas. In most places Edneyville soils make up about 60 percent of the area and Parker soils the rest, but in some places Parker soils predominate. Rounded and semirounded stones of gneiss, 10 to 24 inches or more in diameter, are 3 to 5 feet apart on the surface. Between the stones, the profile is similar to that of Edneyville or Parker soils with similar slopes. Included in mapping are small areas of Colifon and Cokesbury soils.

Although stones generally are concentrated near the surface, they are also numerous throughout the profile. Access roads are easier to install on these soils than on steep stony land, Parker material.

Most of the acreage is wooded. Use of these soils for pasture or hay is severely limited by stones on the surface that make seeding and mowing extremely difficult. Capability unit VIIs–61; woodland group 2x1.

Hazleton Series

The Hazleton series consists of deep, gently sloping to very steep, well-drained soils on uplands. These soils formed in material weathered from fine-grained sandstone that generally is high in feldspars.

In a representative profile the surface layer is dark-brown channery loam about 9 inches thick. It is underlain by a friable, dark yellowish-brown subsurface layer of channery loam about 3 inches thick. The subsoil is friable to slightly firm, yellowish-brown channery loam about 28 inches thick. The substratum is dark yellowish-brown very channery loam. Bedrock is at a depth of about 50 inches.

Hazleton soils have moderately rapid permeability throughout the profile. Available water capacity is moderate, and natural fertility is moderate. Natural reaction is strongly acid, but limed fields are not so acid.

Most Hazleton soils originally contained many stones and channers. Large areas have been cleared for farming, but many of these are now reverting to brush and idle land. Cleared areas are used mostly for corn, small grain, soybeans, hay, and pasture. Erosion control is needed.

Representative profile of Hazleton channery loam, 2 to 6 percent slopes, in a pasture 0.5 mile south of Klinesville:

Ap—0 to 9 inches, dark-brown (10YR 4/3) channery loam; weak; medium and fine, granular structure; very friable; many fine and medium roots; 25 percent coarse fragments up to 6 inches in length; medium acid; abrupt, smooth boundary.

A2—9 to 12 inches, dark yellowish-brown (10YR 4/4) channery loam; very weak, fine, subangular blocky structure that breaks easily to weak, fine, granular; friable; many fine and medium roots; 30 percent coarse fragments ½ inch in width and 3 to 4 inches in length; dark organic stains on many ped faces; medium acid; clear, wavy boundary.

B1—12 to 16 inches, yellowish-brown (10YR 5/4) channery loam; weak, medium, subangular blocky structure; friable; many medium roots; 30 percent coarse fragments 3 to 4 inches in width and 4 to 6 inches in length; dark organic stains on ped faces; medium acid; clear, wavy boundary.

BB21—16 to 24 inches, yellowish-brown (10YR 5/4) channery loam; weak to moderate, medium and coarse, subangular blocky structure; very slightly firm; few coarse roots; very thin, very discontinuous, dull coatings on some ped faces; 30 percent coarse fragments up to 8 inches in length; strongly acid; gradual, wavy boundary.

B22—24 to 33 inches, yellowish-brown (10YR 5/4) channery loam; moderate, medium and coarse, subangular blocky structure; slightly firm; few coarse roots; thin, discontinuous, dull coatings on ped faces; 40 percent coarse fragments up to 10 inches in length; strongly acid; diffuse, irregular boundary.

B23—33 to 40 inches, yellowish-brown (10YR 5/4) channery loam; weak, medium, subangular blocky structure; slightly firm; 45 percent weathered coarse fragments that give variegated color to soil material; strongly acid; gradual, wavy boundary.

C—40 to 50 inches, dark yellowish-brown (10YR 4/4) very channery loam; massive; slightly firm; 60 percent coarse fragments; strongly acid; clear, wavy boundary.

R—50 inches, shattered bedrock of weathered sandstone.

The solum ranges from 40 to 50 inches in thickness. Depth to hard bedrock ranges from 4 to 5 feet or more. Coarse fragments of sandstone as much as 10 inches in length make up 25 to 50 percent of the solum and average about 40 percent. They make up as much as 70 percent of the C horizon.

The A horizon is mainly channery loam or loam. The Ap horizon generally has a hue of 10YR, a value of 4, and a chroma of 4 or 5. The B horizon generally is 10YR in hue, 5 in value, and 4 in chroma. In the C horizon hue is 10YR, value is 4, and chorma is 4 or 5. In places the strongly weathered sandstone causes the C horizon to be variegated in color.

Hazleton soils adjoin Lansdale and Chalfont soils and grade toward them. They lack the mottling and firm Bx horizon characteristic of the somewhat poorly drained Chalfont soils. Hazleton soils have a less clayey B horizon than Lansdale soils and generally are more stony.

Hazleton channery loam, 2 to 6 percent slopes (HaB).—This soil has the profile described as representative for the series. Included in mapping are a few stony areas and a very few moderately well drained areas. A few nearly level soils and small areas of more sloping soils are also included. Also, in a few areas, the subsoil is slightly more clayey than that of this soil. The content of organic matter is moderate, and this soil is easy to till. The platy fragments of sandstone, which are as much as 6 inches in length, interfere slightly with farming operations but reduce the hazard of erosion.

Corn, small grain, soybeans, hay, and pasture are suitable crops. On long slopes contour stripcropping is used to reduce runoff and erosion. Capability unit IIe–58; woodland group 3f1.

Hazleton channery loam, 6 to 12 percent slopes, eroded (HaC2).—This soil has a profile similar to the one described as representative for the series, except that erosion has thinned the original surface layer several inches, and material from the lighter colored subsoil is mixed into the plow layer. Although channers reduce the erosion hazard somewhat, the strong slopes make it necessary to use conservation measures that reduce the erosion hazard and conserve moisture.

In cultivated areas stripcropping, diversion terraces, and cropping systems are used to reduce the runoff and the hazard of further erosion. Capability unit IIIe–58; woodland group 3f1.

Hazleton channery loam, 12 to 18 percent slopes (HaD).—This soil is moderately steep. In places erosion has thinned the original surface layer several inches. Channers on the surface help reduce the hazard of erosion somewhat, but it is still severe. This soil is generally not well suited to continuous row crops. It is better suited to hay, pasture, and small grain. Capability unit IVe–58; woodland group 3f1.

Hazleton very stony loam, 6 to 18 percent slopes (HcC).—This soil has more stones and boulders on the surface and throughout the soil than the profile described as representative for the series. Stones, boulders, and fragments of sandstone are about 5 to 30 feet apart and cover from 1 to 3 percent of the surface.

Most of this soil is wooded; but some of the gentle slopes are in pasture or hay, and a few areas are idle.

Stones make the growing of cultivated crops impractical. Reseeding to improve the grass species is feasible. Capability unit VIs–61; woodland group 3f1.

Hazleton very stony loam, 18 to 40 percent slopes (HcE).—This soil has a profile similar to the one described as representative for the series, except that it contains many stones, which are about 5 to 30 feet apart and cover 1 to 3 percent of the surface.

Stoniness and steepness are major limitations to farming and to many other uses of this soil. It is better suited to growing trees than to other uses. Capability unit VIIs–61; woodland group 3r1.

Klinesville Series

The Klinesville series consists of shallow, gently sloping to moderately steep, well-drained soils on uplands.

In a representative profile the plow layer is mainly reddish-brown shaly loam about 7 inches thick. Directly beneath this lies a reddish-brown very shaly loam subsoil. Shale bedrock is at a depth of about 18 inches.

Permeability is moderately rapid. Available water capacity and natural fertility are low. Natural reaction ranges from medium acid to strongly acid, but limed fields are not so acid. The shallow depth of these soils causes low crop production.

Many areas of these soils are wooded, especially the steeper slopes. Cleared areas of these soils are used for small grain, hay, and pasture. If areas of sloping to moderately steep soils are cleared, careful control of erosion is necessary. Many areas are idle or are reverting to trees.

During periods of prolonged rainfall, the soil becomes saturated and water flows along the surface of the hard bedrock. Water seeps into cellars during these periods.

Representative profile of Klinesville shaly loam, 4 to 12 percent slopes, between Route 523 and Rowland Mills, 2 miles north of West Woods Church Road:

Ap—0 to 7 inches, reddish-brown (5YR 5/4) shaly loam; weak, fine, granular structure; friable; many roots; 25 percent angular shale fragments; medium acid; clear, smooth boundary.

B—7 to 18 inches, reddish-brown (2.5YR 5/4) very shaly loam; weak, medium, subangular blocky structure; friable; few roots; more than 50 percent shale fragments; strongly acid; abrupt, smooth boundary.

R—18 inches, fractured shale bedrock.

The solum is 10 to 20 inches in thickness. Depth to bedrock is 10 to 20 inches. In the Ap horizon hue generally is 5YR or 2.5YR, value ranges from 3 to 5, and chroma is 3 or 4. The B horizon ranges from 10R to 5YR in hue, from 3 to 5 in value, and from 3 to 6 in chroma. The C horizon, where present, has a hue of 10R or 2.5YR, a value of 4 or 5, and a chroma of 3 or 4.

Shale fragments range from 15 to 75 percent in any horizon, but generally they average more than 35 percent in most of the profile.

Klinesville soils adjoin Penn and Reaville soils and grade toward them. They are not so deep to bedrock as Penn and Reaville soils, and they lack the gray colors characteristic of Reaville soils.

Klinesville shaly loam, 4 to 12 percent slopes (KlC).—This soil has the profile described as representative for the series. The depth to bedrock is typically 15 to 18 inches.

Included with this soil in mapping, in the northwestern part of the county near Spring Mills, are areas of soils that are underlain by and formed in material derived from mixed acid and calcareous sandy shale. Some quartzite pebbles derived from the shale are in these areas, and the soils are sandier than normal. Reaction immediately above the bedrock in these areas is less acid than is typical for the series. Small areas of Penn and Bucks soils are also included with this soil. In addition, a few areas of harder slaty shale, characteristic of the Berks soils, are included.

Hazard of erosion, low content of organic matter, droughtiness, and shallowness severely limit the use of this moderately sloping soil for most purposes. It is poorly suited to row crops. Areas of pasture or hay are not subject to undue soil erosion, but these crops do not grow well. Capability unit IVe–66; woodland group 4d1.

Klinesville shaly loam, 12 to 18 percent slopes (KlD).—This soil has a profile similar to the one described as representative for the series, except that the depth to bedrock is less than 15 inches in most places.

A few areas of deeper soils and of soils having lesser slopes are included with this soil in mapping. In the northwestern part of the county, near Spring Mills, the bedrock consists of sandier shale that has a few quartzite pebbles in places. It also has an interbedded acid and calcareous stratum. These differences cause a slightly sandier texture and a slightly less acid reaction near the bedrock. Small areas of hard, slaty, shaly soils, characteristic of the Berks soils, are also included.

Moderately steep slopes, low available water capacity, and a severe hazard of erosion place extreme limitations on the use of this soil. The erosion hazard is less in areas where the soil is used for hay, pasture, trees, or wildlife habitat. Capability unit VIe–66; woodland group 4d1.

Lansdale Series

The Lansdale series consists of deep, nearly level to moderately steep, well-drained, loamy soils. These soils formed on uplands in material weathered from fine-grained sandstone.

In a representative profile the plow layer is dark-brown loam about 10 inches thick. Below it is a brown loam subsurface layer about 4 inches thick. The subsoil is brown or strong-brown, very slightly firm and slightly firm loam about 26 inches thick. The substratum is dusky-red fine sandy loam about 20 inches thick. Coarse sandstone fragments are throughout the profile. They increase in number with depth. Bedrock is at a depth of about 60 inches.

Permeability is moderate in the solum and moderately rapid below. Available water capacity is moderate to high, natural fertility is moderate, and natural reaction is strongly acid.

Most areas of Lansdale soils have been cleared for farming. Control of erosion is needed in these areas. The nearly level to strongly sloping soil is suited to corn, small grain, soybeans, hay, and pasture. The steeper slopes are suited to hay and pasture.

Representative profile of Lansdale loam, 0 to 6 percent slopes, in a hayfield, 1.75 miles north of Stockton on Route 523:

Ap—0 to 10 inches, dark-brown (10YR 4/3) loam; weak, medium and fine, granular structure; very friable; many fine roots; 5 percent sandstone fragments; slightly acid; abrupt, smooth boundary.

A2—10 to 14 inches, brown (7.5YR 5/4) loam; moderate, thick, platy structure; friable; many medium and fine roots; 5 percent sandstone fragments; medium acid; gradual, wavy boundary.

B1—14 to 19 inches, brown (7.5YR 5/4) loam; moderate, medium and fine, subangular blocky structure; very slightly firm in place, friable removed; many medium roots; 10 percent coarse fragments; dark organic stains on some ped faces; strongly acid; gradual, wavy boundary.

B22t—19 to 30 inches, strong-brown (7.5YR 5/6) loam; moderate, medium and coarse, subangular blocky structure; slightly firm; very few roots; thin, discontinuous, slightly shiny coatings on some ped faces; 10 percent coarse fragments; strongly acid; diffuse, wavy boundary.

B23—30 to 40 inches, strong-brown (7.5YR 5/6) loam; weak, coarse, subangular blocky structure parting to medium subangular blocky; slightly firm; discontinuous,

slightly shiny films on ped faces in places; 10 percent coarse fragments; strongly acid; clear, wavy boundary.

IIC—40 to 60 inches, dusky-red (10YR 3/3) fine sandy loam; massive; firm; 15 percent coarse fragments; strongly acid; clear, smooth boundary.

R—60 inches, dusky-red (10YR 3/3), weathered, fractured sandstone bedrock.

The solum ranges from 20 to 40 inches in thickness. Depth to bedrock is 3½ to 5 feet or more. Content of coarse fragments ranges from 5 to 25 percent in the solum and 10 to 40 percent in the C horizon. The Ap horizon has a hue of 10YR or 7.5YR, a value of 4 or 5, and a chroma of 2 or 3. In the B horizon the hue is 7.5YR or 10YR, value is 4 or 5, and chroma ranges from 4 to 6. The texture generally is heavy loam, but in places it ranges from heavy sandy loam to sandy clay loam or their gravelly analogs. The C horizon colors are variable, depending on the color of the rock. Hue ranges from 10YR to 10R, value from 3 to 5, and chroma from 3 to 6. Texture is fine sandy loam or sandy loam or their channery analogs.

Lansdale soils adjoin Hazleton, Penn, Bucks, Abbottstown, and Readington soils. They lack the clay content common to Hazleton and Bucks soils and are deeper than the Penn soils. They lack the mottling common to the Readington and Abbottstown soils.

In this county Lansdale soils are redder in the lower part of the profile than the defined range for the series, but this does not alter their usefulness and behavior.

Lansdale loam, 0 to 6 percent slopes (LaB).—This soil has the profile described as representative for the series. Slopes are mainly 2 to 6 percent. Included in mapping are areas where erosion has removed several inches of the original surface layer, and the lighter colored, sticky material of the subsoil is mixed with the plow layer. In a few of these areas, gravel tends to concentrate on the surface. In places in fields there are shallow gullies. Also included in mapping are small areas of soil that has sandy loam or fine sandy loam throughout its profile. In addition, a few seep areas and areas of moderately well drained soils that are permeable in the substratum are included.

Less than one percent of the acreage is stony and is wooded. These areas are designated by appropriate symbols on the map.

Corn, small grain, soybeans, hay, and pasture are suitable crops. On long slopes in cultivated fields, contour stripcropping is used to reduce the amount of runoff and erosion. Capability unit IIe–55; woodland group 3o1.

Lansdale loam, 6 to 12 percent slopes, eroded (LaC2).—This soil has a profile similar to the one described as representative for the series, except that erosion has removed part of the original surface layer, and the upper part of the subsoil is now mixed into the plow layer or is completely exposed. Gullies are in about 10 percent of the total area, and the erosion hazard is moderately severe. Runoff is rapid, causing a reduction in the amount of rainwater that soaks into the soil. This soil is likely to be more droughty than the less sloping Lansdale soils.

Included with this soil in mapping are a few areas of steeper or more gently sloping soils and a few areas of soils that have a sandy loam surface layer. Small areas where 2 to 5 percent of the surface is covered by stones are also included. They are marked on the map by symbols.

Corn, small grain, hay, and pasture are suitable crops. In cultivated fields contour stripcropping and diversion terraces are used to reduce further erosion and conserve moisture. Capability unit IIIe–55; woodland group 3o1.

Lansdale loam, 12 to 18 percent slopes (LaD).—Erosion has thinned original soil in places, and the upper part of the subsoil is now mixed with the plow layer or is exposed. A few areas have scattered gullies. A few small, stony, wooded areas are indicated on the map by symbols. Included in mapping are a few areas of Hazleton soils. Also included are a few areas of soils that have a sandy loam surface layer.

Rapid runoff, a severe hazard of erosion, and steepness of slope limit the use of this soil for farming and many other purposes. It is poorly suited to continuous row crops, but in places cultivated crops are grown in a cropping system in long rotation with small grain or hay. Capability unit IVe–55; woodland group 3o1.

Lansdowne Series

The Lansdowne series consists of deep, nearly level to gently sloping, moderately well drained to somewhat poorly drained soils. These soils formed in material weathered from old, red, shaly glacial till.

In a representative profile the plow layer is dark reddish-brown silt loam about 7 inches thick. The upper part of the subsoil is reddish-brown, firm heavy silt loam about 6 inches thick. The lower part is very firm, dark reddish-gray, dark reddish-brown, or reddish-brown silty clay or silty clay loam that has some mottles. It is about 32 inches thick. The substratum is dark-red, stratified, shaly silty clay and sandy loam. Bedrock is at a depth of about 60 inches.

In Lansdowne soils the surface layer is moderately permeable, and the subsoil and substratum are slowly permeable. Available water capacity is high, natural fertility is moderate, and natural reaction is medium acid to strongly acid. Frost heaving is severe.

Large areas of Lansdowne soils are idle and are reverting to trees. Corn, soybeans, hay, and pasture are the common crops on these soils. In their natural state the soils have perched water in the upper part of the subsoil in winter and spring. This wetness delays farming operations in spring and induces frost heaving. Alfalfa and winter small grain are not well suited unless drainage is provided.

Representative profile of Lansdowne silt loam, 0 to 6 percent slopes, in an idle field along Route 523, 0.8 mile north of Route 22:

Ap—0 to 7 inches, dark reddish-brown (5YR 3/3) silt loam; moderate, medium, granular structure; friable; many fine and medium roots; 2 percent coarse fragments; medium acid; abrupt, smooth boundary.

B1—7 to 13 inches, reddish-brown (5YR 4/3) heavy silt loam; moderate, medium and fine, subangular blocky structure; slightly firm; many fine and medium roots; a few quartzose pebbles and shale fragments; medium acid; gradual, wavy boundary.

B21t—13 to 18 inches, reddish-gray (5YR 4/2) silty clay; many, medium, distinct, yellowish-red (5YR 5/6), red (2.5YR 4/6), pinkish-gray (7.5YR 7/2), and light-gray (5YR 7/1) mottles; very weak, coarse, prismatic structure parting to strong, medium, subangular and angular blocky; very firm; few medium roots; 5 percent coarse fragments; thick, continuous, shiny coatings on all ped faces; medium acid; clear, wavy boundary.

B22t—18 to 28 inches, reddish-brown (5YR 4/3) silty clay; many, medium, faint, yellowish-red (5YR 5/6) and red (2.5YR 4/6) mottles; weak, very thick, platy structure breaking to strong, fine and medium, subangular and angular blocky; very firm; 10 percent coarse fragments; thick, continuous, shiny coatings

on all ped faces; strongly acid; diffuse, wavy boundary.

B23t—28 to 45 inches, dark, reddish-brown (5YR 3/4) silty clay loam; moderate, thick, platy structure; very firm; thick, discontinuous, slightly shiny clay films on most ped faces; 15 percent coarse fragments, many small angular shale fragments; few, very weathered, gneissic pebbles; strongly acid; diffuse, wavy boundary.

IIC—45 to 60 inches, dark-red (2.5YR 3/6) stratified shaly silty clay and sandy loam; common, medium, distinct, very pale brown (10YR 7/3) mottles; massive; very firm; 20 percent coarse fragments; strongly acid; diffuse, wavy boundary.

R—60 inches, red sandy shale bedrock.

The solum ranges from 40 to 55 inches in thickness. Depth to bedrock is 3½ to 5 feet or more. The percentage of coarse fragments of quartzose, shale, and gneiss ranges from 2 to 20 throughout the profile. The number of fragments increases with depth.

The B horizon is silty clay, heavy silty clay loam, heavy clay loam, or clay. The hue is 5YR or 2.5YR, and the value is 3 or 4. Mottling occurs between depths of 10 and 24 inches. Low chroma mottles are in the upper 10 inches of the B2 horizon.

In places the C horizon has lenses or layers of sandy loam as much as 1 foot in thickness. Texture is sandy loam that consists mainly of sand-sized shale particles. These are of little significance to permeability because the layers are underlain by fine-textured material or bedrock.

Lansdowne soils adjoin Norton, Penn, and Reaville soils and grade toward them. They are deeper than Reaville soils and deeper and firmer than Penn soils. Lansdowne soils are distinctly mottled in the B horizon, but Norton soils are not.

Lansdowne silt loam, 0 to 6 percent slopes (LbB).—This soil has the profile described as representative for the series. Included in mapping are small areas of Norton, Penn, and Reaville soils. Also included, especially around the borders of this soil, are faintly mottled soils that lack low chromas in the subsoil. In addition, a few small areas of soils that have a poorly drained, gray surface layer are included. In these areas gray mottling is immediately below the plow layer.

Impeded subsoil drainage causes a moderately high, seasonal, perched water table and additional runoff. If drainage is provided, this soil is suited to corn, soybeans, small grain, pasture, and mixed hay. Open ditches are used to dispose of surface water. Capability unit IIIw–70; woodland group 3w1.

Lawrenceville Series

Lawrenceville soils are deep, gently sloping to strongly sloping, loamy soils that are moderately well drained. They formed in weathered shale.

In a representative profile the plow layer is commonly dark grayish-brown silt loam about 8 inches thick. The upper part of the subsoil is yellowish-brown, faintly mottled silt loam 20 inches thick. The lower part is a dark-brown, firm, distinctly mottled, silt loam fragipan 12 inches thick. The substratum is dark-brown shaly silt loam 15 inches thick. Weathered bedrock is at a depth of about 55 inches.

The upper part of the solum is moderately permeable, but the fragipan is moderately slowly permeable in the lower part. Available water capacity is high, and natural fertility is moderate. Natural reaction is medium acid or strongly acid, but limed fields are not so acid. Frost heaving is severe.

Most areas of Lawrenceville soils have been cleared and are used for farming. Erosion needs to be controlled in cleared areas. Corn, small grain, soybeans, hay, and pasture are the most common crops.

These soils have a subsoil that is saturated by a perched water table late in winter and early in spring. The wetness delays farming operations in spring and restricts the choice of crops to those that tolerate wetness. If artificial drainage is established, some of these limitations can be overcome.

Representative profile of Lawrenceville silt loam, 2 to 6 percent slopes, on Rocktown-Lambertville Road, 1.5 to 1.75 miles west of Rocktown:

Ap—0 to 8 inches, dark grayish-brown (10YR 4/2) silt loam; weak, coarse and medium, granular structure; very friable; many fine and medium roots; slightly acid; abrupt, smooth boundary.

B21t—8 to 15 inches, yellowish-brown (10YR 5/6) silt loam; few, fine, faint, yellowish-brown (10YR 5/8) and strong-brown (7.5YR 5/6) mottles; weak, medium and thick, platy structure; friable; few medium roots; patchy discontinuous clay films on ped faces; slightly acid; gradual, wavy boundary.

B22t—15 to 19 inches, yellowish-brown (10YR 5/6) silt loam; many, medium, faint, yellowish-red (5YR 5/8) and yellowish-brown (10YR 5/8) mottles; weak, thick, platy structure parting to moderate, fine and very fine, subangular blocky; friable; discontinuous slightly shiny clay films; medium acid; gradual, wavy boundary.

B23t—19 to 28 inches, yellowish-brown (10YR 5/6) heavy silt loam; many, medium and coarse, distinct or prominent, light-gray (10YR 7/1), gray (10YR 6/1), brownish-yellow (10YR 6/8), and yellowish-red (5YR 5/8) mottles; weak, thick, platy structure; firm; 3 percent very weathered shale fragments; thin slightly shiny clay films; medium acid; diffuse, wavy boundary.

Bx—28 to 40 inches, dark-brown (7.5YR 4/4) silt loam; common, medium, prominent light-gray (10YR 7/1), light-brownish-gray (10YR 6/2), and yellowish-brown (10 YR 5/8) mottles; moderate, coarse, prismatic structure parting to moderate, thick, platy; 10 percent shale fragments; moderately thick clay films on ped faces; medium acid; diffuse, wavy boundary.

C—40 to 55 inches, dark-brown (7.5YR 4/4) shaly silt loam; many, medium, prominent, light-gray (10YR 7/1), light brownish-gray (10YR 6/2), and yellowish-brown (10YR 5/8) mottles; massive; firm; 20 percent shale fragments; medium acid; abrupt, smooth boundary.

R—55 inches, weathered metamorphosed shale.

The solum ranges from 40 to 50 inches in thickness. Depth to a fragipan ranges from 25 to 35 inches, and depth to bedrock from 3½ to 7 feet. The A horizon texture is silt loam, and the B horizon is silt loam or silty clay loam. The B horizon has a value of 4 or 5 and a chroma of 4 or 6. In the C horizon the value is 4 or 5, and the chroma is dominantly 4 but ranges to 6. Low-chroma mottles are at a depth of more than 18 inches. Mottles range from distinct to prominent.

Lawrenceville soils adjoin Neshaminy, Mount Lucas, and Lehigh soils and grade toward them. They form a fringe on the gentle slopes at the base of traprock hills in a position immediately below the mottle-free Neshaminy soils. Generally, they are between Neshaminy and Lehigh soils. Lawrenceville soils are less clayey and contain less rock fragments than the moderately well drained to somewhat poorly drained Mount Lucas soils that are on flats or concave slopes at higher elevations on the hills. They are yellowish brown and have fewer shale fragments than the gray, somewhat poorly drained Lehigh soils that lie between these soils and the Penn and Bucks soils. Generally they have diabase fragments.

Lawrenceville silt loam, 2 to 6 percent slopes (LeB).—This soil has the profile described as representative for the series. Included in mapping are areas of nearly level soils, areas of well-drained soils, and, in places, soils that have gray mottles at a depth of less than 18 inches. In a few

included areas, the soil has eroded to the extent that the yellower, slightly more clayey material from the subsoil is mixed into the plow layer, or the subsoil is exposed.

This soil is slow to dry in spring, and plowing is frequently delayed. It is suited to corn, soybeans, mixed hay, and pasture. Smaller crops of alfalfa and winter small grain are the result of frost heaving and winterkill. Open drains and diversion terraces are used to remove excess water and to control erosion on long slopes. Capability unit IIe–71; woodland group 2w1.

Lawrenceville silt loam, 6 to 12 percent slopes, eroded (LeC2).—In this soil gullies are common in both cultivated areas and idle land. Included in mapping are well-drained and somewhat poorly drained soils and, in a few areas, poorly drained soils. Also included are a few areas of stony soils.

Runoff is rapid, and the erosion hazard is moderately severe. Contour cultivation and stripcropping are used to reduce the hazard of further erosion. Capability unit IIIe–70; woodland group 2w1.

Legore Series

The Legore series consists of deep, gently sloping to sloping, well-drained soils. They formed in saprolite that weathered from dark-colored, basic, medium-grained igneous rock. These rocks are principally diabase but also contain fine-grained basalts.

In a representative profile the surface layer is dark-brown gravelly loam about 9 inches thick. The subsoil is yellowish-brown gravelly heavy loam about 13 inches thick. The substratum is reddish-brown very gravelly loam 28 inches thick. Bedrock is at a depth of about 50 inches.

Legore soils are moderately permeable or moderately rapidly permeable throughout the profile. Available water capacity and natural fertility are moderate. Natural reaction is medium acid.

Extensive areas of these soils are wooded; small areas have been cleared of trees and are cultivated. Erosion control is needed.

Representative profile of Legore gravelly loam, 2 to 6 percent slopes, in a pasture along the Rocktown-Lambertville Road, 1.1 miles west of Rocktown:

Ap—0 to 9 inches, dark-brown (7.5YR 4/4) gravelly loam; moderate, fine, granular structure; friable; many fine and medium roots; 30 percent coarse fragments ⅛ inch to 6 inches in diameter; medium acid; abrupt, smooth boundary.

Bt—9 to 22 inches, yellowish-brown (10YR 5/6) gravelly heavy loam; weak, medium, subangular blocky structure; friable; many coarse roots; more than 30 percent coarse fragments ⅛ inch to 6 inches in diameter; a few stones; medium acid; gradual, smooth boundary.

C—22 to 50 inches, reddish-brown (5YR 4/4) gravelly loam; massive; friable; 35 percent coarse fragments ⅛ inch to 10 inches in diameter; medium acid.

R—50 inches, weathered diabase bedrock.

The solum ranges from 20 to 34 inches in thickness but averages about 30 inches. Depth to bedrock ranges from 5 to 8 feet or more. Coarse fragments, which are throughout the profile, generally range from fine gravel to stone. They increase in size with depth. In the A, B, and C horizons, the percentage of coarse fragments ranges from 5 to 35; in the A and B horizons, the average percentage is 30.

The Ap horizon has a hue of 10YR or 7.5YR, a value of 3 or 4, and a chroma of 2 or 4. In the Bt horizon hue is 10YR, 7.5YR, or 5YR; value is 4 or 5; and chroma ranges from 4 to 6. The texture is gravelly heavy loam or light clay loam. Generally the C horizon is a deep saprolite completely surrounding huge boulders that have been rounded by weathering.

Legore soils adjoin Neshaminy and Mount Lucas soils and grade toward them. They have a thinner solum and contain more coarse fragments than Neshaminy soils. The lack of mottling distinguishes them from Mount Lucas soils.

Legore gravelly loam, 2 to 6 percent slopes (LgB).—This soil has the profile described as representative for the series. Included in mapping are areas of Neshaminy and Mount Lucas soils and small spots of poorly drained Watchung soils. Also included in places are areas where the soil is stony and areas where bedrock is at a depth of less than 3½ feet. In a few places there are rock outcrops.

These soils are suited to corn and small grain. Deep-rooted grasses and legumes grow well. Runoff and erosion are slight on short slopes and can be easily controlled through good management practices. On long slopes contour stripcropping is used to reduce the moderate erosion hazard. Capability unit IIe–58; woodland group 3o1.

Legore gravelly loam, 6 to 12 percent slopes (LgC).—This soil has a profile similar to that described as representative for the series. Included in mapping are cultivated or idle areas where the soil is eroded or severely eroded. Also included are a few areas of deeper Neshaminy and Mount Lucas soils, areas where the soil is very stony, and a few areas where rock crops out. Also, in a few areas, bedrock is at a depth of less than 3½ feet.

Runoff is rapid on this soil, and the available water capacity is lower than it is in the less sloping Legore soils. Corn and small grains are suitable crops if erosion is controlled. Deep-rooted grasses and legumes grow well. Contour stripcropping supplemented by diversion terraces and grassed waterways is used to reduce the hazard of erosion. Capability unit IIIe–58; woodland group 3o1.

Legore gravelly loam, 12 to 18 percent slopes (LgD).—This soil has a profile similar to that described as representative for the series. It is moderately steep and the erosion hazard is severe. Included in mapping are a few areas of deeper Neshaminy soils, a few areas where bedrock is at a depth of less than 3½ feet, and a few rock outcrops.

Rapid runoff, severe erosion, and steepness of slope limit the use of this soil. It is poorly suited to row crops, but in places they are grown in a cropping system that includes small grain or hay. Most of the acreage is wooded. Capability unit IVe–58; woodland group 3o1.

Lehigh Series

Lehigh soils are deep, gently sloping to moderately steep, and moderately well drained to somewhat poorly drained. They formed in material weathered from shale or siltstone. These soils are on uplands.

In a representative profile the plow layer is dark grayish-brown silt loam about 9 inches thick. The upper part of the subsoil is dark-brown silt loam that has gray mottles. It is about 11 inches thick. The lower part of the subsoil is dark-brown, mottled, shaly silt loam about 10 inches thick. Beneath this is mottled, dark grayish-brown, firm shaly silt loam 12 inches thick. Weathered shale bedrock is at a depth of 42 inches.

The upper horizons of Lehigh soils are moderately slowly permeable, but the firm lower part of the subsoil is slowly permeable. Available water capacity is high, nat-

ural fertility is moderate, and natural reaction is medium or strongly acid. Seeps are in some areas.

Extensive areas of Lehigh soils have been cleared and used for farming, but many areas are now idle and reverting to trees. Where cleared, the sloping to moderately steep soils require erosion-control measures. These soils dry slowly in spring because of a perched water table, the lateral movement of water over the firm subsoil, and the seepage from below. They are better suited to hay and pasture than to other uses; but if drainage is provided, they are also suited to corn, small grain, and soybeans.

Representative profile of Lehigh silt loam, 2 to 6 percent slopes, 1.5 miles southwest of Linvale:

Ap—0 to 9 inches, dark grayish-brown (10YR 4/2) silt loam; weak, medium, granular structure; friable, nonsticky; many fine roots; 5 percent shale fragments; medium acid; abrupt, smooth boundary.

B21t—9 to 14 inches, dark-brown (7.5YR 4/2) silt loam; few, fine, faint, light reddish-brown (5YR 6/3) and pinkish-gray (5YR 7/2) and distinct strong-brown (7.5YR 5/8) mottles; very weak, very thick, platy structure parting to weak, fine, subangular blocky; friable, nonsticky; few medium and coarse roots; thin discontinuous clay films on ped faces; 10 percent shale fragments; medium acid; clear, wavy boundary.

B22t—14 to 20 inches, dark-brown (7.5YR 4/2) heavy silt loam; common, medium, faint, pinkish-gray (5YR 6/2), reddish-brown (5YR 4/4), and light reddish-brown (5YR 6/3) mottles; moderate, medium, subangular blocky structure; slightly firm; few coarse roots; thick shiny coatings on most ped faces; 15 percent shale fragments; medium acid; diffuse, wavy boundary.

B23t—20 to 30 inches, dark-brown (7.5YR 4/2) shaly silt loam; common, medium, faint, pinkish-gray (5YR 6/2), reddish-brown (5YR 4/4), and light reddish-brown (5YR 6/3) mottles; weak, medium, subangular blocky structure; firm, nonsticky; 25 percent shale fragments; strongly acid; gradual, wavy boundary.

C—30 to 42 inches, dark grayish-brown (10YR 4/2) shaly silt loam; common, medium and coarse, faint, light-gray (5YR 7/1), reddish-brown (5YR 4/4), and yellowish-red (5YR 5/6) mottles; very weak, very thick, platy structure; firm; 40 percent shale fragments; strongly acid; abrupt, wavy boundary.

R—42 inches, weathered metamorphosed shale bedrock.

The solum ranges from 20 to 40 inches in thickness. Depth to bedrock ranges from 3½ to 5 feet or more. Percentage of coarse fragments ranges from 5 to 35 in the A and B horizons and from 40 to 60 in the C horizon. The Ap horizon has a hue of 10YR, a moist value of 3 or 5, and a dry value of more than 5. The A horizon is mainly silt loam, which is very stony in places. The B horizon has a matrix hue of 7.5YR or 10YR, a value generally of 4 or 5, and a chroma of 1 to 3. The B horizon ranges in texture from silt loam to a light silty clay loam. Shaly coarse fragments are in this horizon. In the C horizon hue is commonly 10YR.

Lehigh soils adjoin Penn, Reaville, and Mount Lucas soils and grade toward them. Their grayish colors distinguish them from the shallower, redder, well-drained Penn soils. They are deeper to bedrock than Reaville soils and grayer than Mount Lucas soils.

Lehigh silt loam, 2 to 6 percent slopes (LhB).—This soil has the profile described as representative for the series. Included in mapping are small areas of nearly level soils that have a thicker surface layer and areas of shaly silt loam or channery silt loam. Also included are small areas of well drained Penn soils and moderately well drained Lawrenceville soils. In addition, a few small areas of poorly drained Croton soils and somewhat poorly drained Chalfont soils are included.

This soil is better suited to mixed hay crops and pasture than to other crops. Grasses and legumes that tolerate wetness can be grown. The soil generally is wet in spring and cannot be plowed early. If drained, it is suited to corn, soybeans, and spring-seeded small grain. Open drains and diversion terraces are used to remove excess water and control erosion. Capability unit IIIw–70; woodland group 3w1.

Lehigh silt loam, 6 to 12 percent slopes, eroded (LhC2).—This soil has a profile similar to that described as representative for the series, except that the original surface layer has been thinned by erosion. In normal plowing operations, the lighter colored, slightly heavier subsoil is mixed with the plow layer or is exposed at the surface. Shallow gullies are common.

Included with this soil in mapping are small areas of moderately well drained Lawrenceville soils and well drained Penn soils. Also included are a few small areas of somewhat poorly drained Chalfont soils, a few wooded areas where the soil is not eroded, and a few areas of channery or stony soil.

This soil is better suited to grasses and legumes that tolerate wetness than to other uses. If cultivated, the hazard of erosion is moderately severe. Diversion terraces and grassed waterways are used to manage excess surface water and reduce the hazard of further erosion. Capability unit IIIe–70; woodland group 3w1.

Lehigh silt loam, 12 to 18 percent slopes, eroded (LhD2).—This soil has been thinned by erosion, but the profile is otherwise similar to the one described as representative for the series. Much of the cultivated soil is only 30 to 36 inches deep over bedrock. It has rapid runoff and is highly susceptible to erosion. Gullies are common. Seepage is severe in places. Shaly and channery textures are common, and there are some stony areas. Included in mapping are small areas of well-drained Penn soils.

About one-third of the areas are wooded, and in these areas depth to bedrock is about 40 inches. This soil is not well suited to row crops. It is better suited to small grain, hay, and pasture. Cover crops, contour stripcropping, diversion terraces, and cropping systems that include sod can be used to reduce the hazard of further erosion. Capability unit IVe–65; woodland group 3w1.

Lehigh very stony silt loam, 2 to 6 percent slopes (LkB).—This soil has a profile similar to that described as representative for the series, except that the surface layer contains many stones that are 3 to 30 feet apart. Many stones are throughout the profile, and they increase in number with depth. Runoff and the hazard of erosion are moderate.

The soil is not suitable for cultivation until the stones have been removed. It is well suited to pasture or trees. Capability unit VIs–75; woodland group 3w1.

Lehigh very stony silt loam, 6 to 18 percent slopes (LkC).—This soil has a profile similar to the one described as representative for the series, except that gray shale stones are 3 to 30 feet apart in the surface layer and increase in number with depth.

Stones, wetness, and the moderately severe erosion hazard limit the use of this soil; but it is suited to pasture and trees. Capability unit VIs–75; woodland group 3w1.

Made Land

Made land (Ma) includes sanitary landfill, dumps, and rockfill. The dumps and rockfill are exposed at the surface, but the sanitary landfill is covered with as much as two feet of soil material. Sanitary landfill contains trash of all kinds, including garbage. Decomposition causes liquids and gases to form, resulting in an uneven settling of the area. Not placed in a capability unit; no woodland classification.

Meckesville Series

Meckesville soils are deep, gently sloping to strongly sloping, well drained, and loamy. These soils formed on uplands in a mantle of old gneissic drift over firm red till.

In a representative profile, in a cultivated area, the plow layer is dark-brown gravelly loam about 10 inches thick. The upper part of the subsoil is friable, reddish-brown loam and silt loam about 21 inches thick. The lower part is a firm, weak-red, loam fragipan about 7 inches thick. The substratum is weak-red loam that is very firm. Red shaly sandstone is at a depth of about 60 inches.

Meckesville soils are moderately permeable in the surface layer and the upper part of the subsoil to a depth of about 30 inches and slowly permeable in the lower part of the subsoil. They generally are strongly acid and moderately fertile. They have a high available water capacity.

Most areas of Meckesville soils have been cleared and are used for dairying. Control of erosion is needed. Hay is the most common crop, and many areas are used for pasture. Severe damage to crops of alfalfa is caused by heaving of these soils. Small areas are used for corn, small grain, and soybeans.

Representative profile of Meckesville gravelly loam, 2 to 6 percent slopes, in a cultivated field, along the Pittstown-Jutland Road, 0.75 mile north of Pittstown:

Ap—0 to 10 inches, dark-brown (7.5YR 3/2) gravelly loam; weak, medium, subangular blocky structure parting to weak, fine, granular; very friable; many fine and medium roots; 15 percent rounded quartzite and gneiss pebbles and cobblestones; medium acid; clear, smooth boundary.

B21t—10 to 23 inches, reddish-brown (5YR 4/4) heavy loam; weak, medium, subangular blocky structure; friable; few medium roots; dull coatings on most ped faces; 10 percent rounded quartzite and gneiss pebbles and cobblestones; strongly acid; gradual, smooth boundary.

B22t—23 to 31 inches, reddish-brown (5YR 4/3) heavy silt loam; moderate, medium, subangular blocky structure; friable; shiny clay films on all ped faces; 10 percent rounded quartzite and gneiss pebbles and cobblestones; strongly acid; gradual, smooth boundary.

Bx—31 to 38 inches, weak-red (2.5YR 4/2) heavy loam; weak, coarse, angular and subangular blocky structure; firm; patchy clay films on ped faces; manganese stains on ped faces; 10 percent quartzite and gneiss pebbles and cobblestones; strongly acid; clear, smooth boundary.

C—38 to 60 inches, weak-red (2.5YR 4/2) loam; massive; very firm; many manganese stains; 10 percent coarse fragments of weathered gneiss; strongly acid.

R—60 inches, red shaly sandstone, deeply weathered but retains rock structure and moderate hardness.

The solum ranges from 38 to 55 inches in thickness. Depth to the fragipan is 26 to 40 inches. Depth to reddish sandy shale or sandstone bedrock is 5 to 8 feet. Content of coarse fragments, consisting of gneiss, quartzite, and chert, ranges from a trace to as much as 20 percent in any horizon.

The Ap horizon has a hue of 7.5YR and 10YR, and the B horizon has a hue of 5YR to 2.5YR. In both of these horizons, value is 4 or 5 and chroma is 2 to 6. Texture of the B horizon is heavy silt loam, silty clay loam, clay loam, or heavy loam and their gravelly analogs. In the C horizon color is similar to that of the B horizon, and hue is 2.5YR or 10R. Texture is loam or clay loam and their gravelly analogs.

Meckesville soils adjoin Norton soils and grade toward them. They contain less clay than Norton soils. They have a redder Bx horizon than that of Annandale soils.

Meckesville gravelly loam, 2 to 6 percent slopes (MeB).—This soil has the profile described as representative for the series. In places gneiss and quartzite gravel in the surface layer is less than 20 percent. Included in mapping are fields where the soil is eroded. Several inches of the original surface layer have been washed from the soil. Gullies are present in places.

This soil is suited to corn, small grain, soybeans, hay, and pasture. Rapid runoff and at least moderate erosion result because of the slowly permeable subsoil. Contour stripcropping is used on long slopes to reduce the amount of runoff and erosion. Capability unit IIe–51; woodland group 2o1.

Meckesville gravelly loam, 6 to 12 percent slopes, eroded (MeC2).—This soil has a profile similar to the one described as representative for the series, except that erosion has thinned the original surface layer several inches, and material from the more clayey subsoil is mixed into the plow layer. Also, the firm, red lower part of the subsoil is nearer the surface as a result of the erosion, and the available water capacity is lower.

Runoff is rapid, organic matter is low and difficult to maintain, and the erosion hazard is moderately severe. Intense conservation practices are needed to conserve moisture and to reduce the hazard of further erosion. Capability unit IIIe–51; woodland group 2o1.

Mount Lucas Series

The Mount Lucas series consists of deep, nearly level to gently sloping, moderately well drained and somewhat poorly drained, loamy soils that contain diabase coarse fragments. The lower part of the subsoil is mottled and slightly firm. These soils formed in material weathered from diabase rock. They are on uplands in the Piedmont section of the county.

In a representative profile the plow layer is dark-brown silt loam about 9 inches thick. Immediately below this is a strong-brown, friable silt loam subsurface layer about 3 inches thick. The upper part of the subsoil is yellowish-brown silt loam about 6 inches thick. The middle part is yellowish-brown, distinctly mottled silty clay loam about 14 inches thick. The lower part of the subsoil is strong-brown silt loam about 8 inches thick. It contains a few fragments of diabase rock. The substratum is strong-brown silt loam.

Permeability is slow or moderately slow, natural fertility is moderate, and natural reaction is medium acid. Available water capacity is high.

Most areas of Mount Lucas soils are wooded. Very small areas have been cleared and are cultivated. Where cleared, the gently sloping soils require erosion control.

The soils dry slowly in spring because of a perched water table and seepage from upper slopes. These conditions keep the subsoil saturated throughout most of the

later winter months. Wetness restricts crop production and the type of crops that can be grown. These limitations can be overcome through the installation of artificial drainage systems. Where drainage is provided these soils respond well to applications of fertilizer and retain a high amount of moisture available for plant use. If these soils are drained, they are suited to corn, small grain, hay, and pasture.

Representative profile of Mount Lucas silt loam, 0 to 6 percent slopes, in a wooded area near Buttonwood Corners:

O1—¼ inch to 0, thin layer of organic litter.
Ap—0 to 9 inches, dark-brown (10YR 4/3) silt loam; moderate, medium and fine, granular structure; friable; many coarse and medium roots; extremely acid; clear, wavy boundary.
A2—9 to 12 inches, strong-brown (7.5YR 4/6) silt loam; weak, medium, subangular blocky structure breaking to moderate, medium, granular; friable; many medium roots; many wormholes and root channels filled with material from the Ap horizon; extremely acid; clear, wavy boundary.
B1—12 to 18 inches, yellowish-brown (10YR 5/6) silt loam; moderate, coarse, subangular blocky structure; friable; slightly hard when dry; a few diabase fragments 9 to 10 inches in diameter; extremely acid; gradual, wavy boundary.
B2t—18 to 32 inches, yellowish-brown (10YR 5/6) light silty clay loam; common, fine and medium, distinct, light-gray (10YR 7/1) brownish-yellow (10YR 6/6), and strong-brown (7.5YR 5/6) mottles; strong, coarse and medium, subangular blocky structure; slightly firm, hard when dry; patchy, moderately thick, redder, shiny coatings on most ped faces; a few diabase fragments 7 inches in diameter; many dark manganese stains; very strongly acid; diffuse, wavy boundary.
B3—32 to 40 inches, strong-brown (7.5YR 5/6) silt loam; common, medium, distinct, pinkish-gray (7.5YR 7/2), light-gray (N 7/0), and yellowish-brown (10YR 5/8) mottles; weak, thick, platy structure; slightly firm, hard when dry; a few very patchy, thick, shiny clay films in narrow strips that are much greater in length than in width; a few diabase fragments 7 to 10 inches in diameter; strongly acid; diffuse, wavy boundary.
C—40 to 60 inches, strong-brown (7.5YR 5/6) silt loam; common, fine, faint, light-gray (10YR 7/2) mottles; massive, slightly firm; medium acid.

The solum ranges from 25 to 50 inches in thickness. Depth to hard bedrock ranges from 4 to 8 feet or more. There are many diabase stones and boulders in the surface layer in wooded areas, but stones have been removed from most cropland. Content of coarse fragments ranges from 5 to 20 percent throughout the solum but is as much as 40 percent in the C horizon.

The Ap horizon has a hue of 10YR or 7.5YR, a value of 4 or 5, and a chroma of 2 to 4. The B horizon has a matrix hue of 10YR to 5YR, a value of 4 to 6, and a chroma of 3 to 6. Where mottled, value is as high as 7, and chroma ranges from 1 to 8. Texture ranges from heavy silt loam to silty clay loam. In the C horizon textures range from loam or silt loam to sandy loam.

Mount Lucas soils adjoin Neshaminy, Lehigh, Lawrenceville, and Watchung soils and grade toward them. Mottling in the B horizon distinguishes Mount Lucas soils from Neshaminy soils. Mount Lucas soils are not so gray as Watchung soils, and they lack the fragipan characteristic of Lawrenceville soils. Their B horizon is not so dark brown as that of Lehigh soils.

Mount Lucas silt loam, 0 to 6 percent slopes (MoB).—This soil has the profile described as representative for the series. Included in mapping are nearly level soils that have a surface layer several inches thicker than that described in the representative profile. The additional thickness is the result of accumulated deposits washed from surrounding slopes. Also included are small areas of soils that have slopes of more than 6 percent and less extensive areas of poorly drained Watchung soils.

The total cultivated acreage of this soil is very small. Corn, small grain, hay, and pasture plants are the common crops.

Runoff is slow, and the water table is seasonally moderately high. Erosion is the major limitation where this soil is farmed. Graded stripcropping supplemented by diversion terraces and grassed waterways is used to reduce the amount of erosion. Capability unit IIe–71; woodland group 2w1.

Mount Lucas-Watchung very stony silt loams, 0 to 6 percent slopes (MwB).—The profiles of the soils in this complex are similar to those described as representative for their series, except that stones 10 to 24 inches in diameter are spaced 3 to 30 feet apart in the surface layer (fig. 10).

This mapping unit is about 70 percent Mount Lucas soils and 30 percent Watchung soils, but the proportions vary somewhat from place to place. Most slopes are 1 to 4 percent. Included in mapping are a few areas where slope is as much as 12 percent. Some areas of Legore and Neshaminy soils are also included.

The severe limitations caused by wetness and stoniness have restricted these soils to residential use and the growth of trees. Where these soils have been cleared, runoff and the erosion hazard are moderate. Capability unit VIIs–77; woodland group 2w1.

Neshaminy Series

The Neshaminy series consists of deep, gently sloping to very steep, well-drained soils that formed in material weathered from dark igneous rocks of diabase or basalt.

Figure 10.—**Wooded area of Mt. Lucas-Watchung very stony silt loams. Stones and boulders make tillage impractical.**

In a representative profile, in a wooded area, the surface layer, subsurface layer, and upper part of the subsoil are dark-brown silt loam. Their combined thickness is 11 inches. The lower part of the subsoil is strong-brown silt loam and silty clay loam about 31 inches thick. The substratum is friable, reddish-brown gravelly loam 18 inches thick. Hard diabase or basalt bedrock is at a depth of about 60 inches.

Permeability is moderate in the upper horizons and moderately slow in the lower part of the subsoil. Available water capacity is high in the silt loam and moderate in the very stony silt loam. Natural fertility is high, and natural reaction is medium acid to strongly acid. Heavily limed fields are not so acid.

In their natural condition, Neshaminy soils contain many stones. On most of the cleared, lower slopes, stones that were near the surface have been removed to make farming easier. The steeper, wooded slopes generally contain stones, boulders, and rock outcrops.

The native vegetation consists of oaks, hickories, ash, and yellow-poplar. About half of the lower slopes have been cleared of trees and stones for farming. Corn, small grain, soybeans, hay, and pasture are the most extensively grown crops. The soils are erodible if farmed.

Representative profile of Neshaminy silt loam, 2 to 6 percent slopes, along Rocktown-Lambertville Road, 0.5 to 0.75 mile west of Rocktown:

O1—½ to ¼ inch, leaf litter from the preceding year.
O2—¼ inch to 0, dark-brown (7.5YR 3/2) decayed organic matter.
A1—0 to 2 inches, dark-brown (7.5YR 4/2) silt loam; weak, medium and fine, granular structure; friable; many fine roots; strongly acid; clear, irregular boundary.
Ag2—2 to 6 inches, dark-brown (7.5YR 4/4) silt loam; very weak, medium and fine, subangular blocky structure; very friable; many medium and fine roots; 3 percent diabase fragments ½ to 1 inch in diameter; strongly acid; clear, wavy boundary.
B1—6 to 11 inches, dark-brown (7.5YR 4/4) heavy silt loam; weak, medium, subangular blocky structure; friable; many medium roots; 5 percent angular diabase fragments 1½ to 3 inches in diameter; strongly acid; clear, wavy boundary.
B21t—11 to 17 inches, strong-brown (7.5YR 5/6) light silty clay loam; moderate, medium and fine, subangular blocky structure; friable; few coarse roots; thin, discontinuous, shiny clay films on some ped faces; 5 percent angular diabase fragments mostly 1½ to 3 inches in diameter, a few as much as 10 inches in diameter; strongly acid; gradual, wavy boundary.
B22t—17 to 30 inches, strong-brown (7.5YR 5/6) silty clay loam; strong, coarse, subangular blocky structure; friable; thick, discontinuous, redder shiny clay films on most ped faces; 15 percent angular diabase fragments, 1 to 4 inches in diameter; strongly acid; gradual, wavy boundary.
B3—30 to 42 inches, strong-brown (7.5YR 5/6) silt loam; massive; firm, discontinuous, redder, slightly shiny coatings in fractures; 15 percent diabase fragments ranging from ¼ to 4 inches in diameter, a few stones 10 to 20 inches in diameter; medium acid; clear, wavy boundary.
C—42 to 60 inches, reddish-brown (5YR 5/4) gravelly loam; massive; friable; 30 percent coarse diabase fragments and some stones; medium acid; abrupt, irregular boundary.
R—60 inches, hard, fine-grained diabase.

The solum ranges from 36 to 54 inches in thickness. Depth to bedrock is 4 to 8 feet or more. The coarse fragment content ranges from 5 to 20 percent in the A and B horizons and from 20 to 50 percent in the C horizon. Surface stoniness ranges from stone-free to extremely stony. In a few areas boulders 24 to 200 inches in diameter are common on the surface and within the profile.

The A horizon has a hue of 10YR or 7.5YR, a value of 3 to 5, and a chroma of 2 to 4. The texture is silt loam or gravelly loam. The B horizon has a hue of 7.5YR or 5YR, a value of 4 or 5, and a chroma of 4 to 8. Average clay content is less than 35 percent but exceeds this in certain subhorizons. Texture ranges from silt loam to silty clay loam and their gravelly analogs. The C horizon has a hue of 5YR or 7.5YR and ranges to 2.5YR, a value of 4 or 5, and a chroma of 4 to 6. Texture ranges from gravelly loam to gravelly sandy loam.

Neshaminy soils adjoin Mount Lucas, Legore, and Lawrenceville soils. They lack the mottles characteristic of Mount Lucas and Lawrenceville soils. The solum is thicker, and there is less gravel than in the Legore soils, even though they formed on the same kind of bedrock. The nearby Watchung soils also formed on this bedrock but are at a lower elevation than Neshaminy soils. Their dominantly gray color indicates prolonged periods of wetness.

Neshaminy gravelly loam, 2 to 6 percent slopes (NdB).—This soil is similar to the one described as representative for the series, except that it is more than 15 percent pebbles and stones throughout the profile. The frequency of pebbles and stones increase with depth. Also, this soil has slightly more sand throughout the profile than the one described as representative for the series. The depth to bedrock generally is about 3½ feet, which is a little less than is normal for the series. Included in mapping are small areas where slopes are more than 6 percent.

Available water capacity is lower for this soil than for Neshaminy silt loam. Runoff is moderate, and the erosion hazard is moderate.

Most of the acreage is wooded. Because this soil is sandier and more permeable than the other Neshaminy soils, it is less suited to pond construction. Seepage into the sandy substratum is likely. Capability unit IIe–55; woodland group 2o1.

Neshaminy silt loam, 2 to 6 percent slopes (NeB).—This soil has the profile described as representative for the series. Included in mapping are some nearly level soils that have several inches of deposits that have been washed from the surrounding slopes. Also included are some areas where the soil has more than 15 percent diabase fragments scattered throughout the profile and small areas of soil that has been thinned by erosion so that the more clayey subsoil material is mixed with the plow layer or is exposed. In addition, a few small areas of a moderately well drained soil and of somewhat poorly drained Mount Lucas soils are included. Other small inclusions are moderately well drained Lawrenceville soils.

This soil is suited to corn, small grain, soybeans, and grasses. On short slopes the erosion hazard is slight and runoff is moderate. Contour stripcropping is used on long slopes to reduce runoff and erosion. Capability unit IIe–55; woodland group 2o1.

Neshaminy silt loam, 6 to 12 percent slopes, eroded (NeC2).—This soil has a profile similar to that described as representative for the series, except that erosion has thinned the original surface layer in fields so that the lighter colored and more clayey subsoil material is mixed with the plow layer or is exposed. Some areas included in mapping are wooded and are not eroded. These areas are stony in places. Also included, mainly in cultivated areas of eroded soil, are places where 15 percent or more of the horizons is diabase rock fragments 3 to 10 inches in di-

ameter. These fragments are scattered throughout the profile.

Runoff is rapid, and the erosion hazard is moderately severe. The most common crops are corn, small grain, hay, and pasture. Cover crops, contour stripcropping, diversion terraces, and cropping systems that include sod are used to conserve moisture and reduce the hazard of further erosion. Capability unit IIIe–55; woodland group 2o1.

Neshaminy very stony silt loam, 2 to 12 percent slopes (NhC).—This soil is similar to the one described as representative for the series, except that stones larger than 10 inches in diameter are spaced 3 to 30 feet apart. In many areas the surface layer is more than 15 percent gravel. The depth to bedrock generally is about 3½ feet, which is a little shallower than is normal for the series. Included in mapping are small areas of lesser sloping soils and a few areas of steeper soils.

Most of the acreage is wooded and is on Cushetunk Mountain in the vicinity of Round Valley. Where this soil is cleared and the stones are removed, runoff is rapid, and the erosion hazard is moderately severe on the strong slopes. Capability unit VIs–61; woodland group 2o1.

Neshaminy very stony silt loam, 12 to 18 percent slopes (NhD).—This soil is similar to the soil described as representative of the series, except for its many stones larger than 10 inches in diameter that are spaced 3 to 30 feet apart. Soil in different areas contains varying amounts of gravel. The depth to bedrock generally is about 3½ feet, which is a little less than is normal for the series. Most of this soil is on Cushetunk Mountain in the vicinity of Round Valley. Included in mapping are small areas where slopes are less than those of this soil and a few areas where slopes are steeper.

Nearly all of the acreage is wooded. Runoff is rapid. The hazard of erosion is severe in cleared areas of this soil. This limitation makes it much less suited to farming than Neshaminy very stony silt loam, 2 to 12 percent slopes. Capability unit VIs–61; woodland group 2o1.

Neshaminy very stony silt loam, 18 to 40 percent slopes (NhD).—This soil is similar to the soil described as representative for the series, except that stones larger than 10 inches in diameter are spaced 3 to 15 feet apart. The depth to bedrock generally is about 3½ feet, which is less than is normal for the series. A few even shallower areas of soil and a few rock outcrops are included in the mapping.

Nearly all of the acreage is wooded. In cleared areas, runoff is very rapid, and the erosion hazard is very severe. The soil is so steep and stony that it is not suitable for residential developments or for individual residences. Access roads are difficult to construct and onsite septic systems are difficult to install. Capability unit VIIs–61; woodland group 2r1.

Neshaminy-Mount Lucas very stony silt loams, 2 to 12 percent slopes (NkC).—This complex is about 70 percent Neshaminy soils and 30 percent Mount Lucas soils. Each has a profile similar to the one that is representative for its series. Both of these soils occur in each mapped area but not necesarily in the same proportion. These very stony soils are not mapped individually, because the intensity of use does not warrant greater detail. The well-drained Neshaminy soils are in the higher positions. The moderately wet Mount Lucas soils are in lower positions in the landscape where they receive much runoff from the adjacent, more sloping soils. Diabase stones larger than 10 inches in diameter are 3 to 30 feet apart.

Most of the acreage is wooded. Cleared areas are used mainly for hay and pasture. Stones and, in some places, wetness limit the use of this complex for tilled crops. Reseeding to improved grasses is feasible. In places it is practical to remove stones from the surface so that more soil will be available for crops or pasture. If the stones are removed, these soils are suited to corn, small grain, and soybeans, in addition to hay and pasture. Capability unit VIs–61; woodland group 2o1.

Norton Series

The Norton series consists of deep, gently sloping to moderately steep soils that formed on rounded slopes and divides in material weathered from old red shale glacial till.

In a representative profile, in a cultivated field, the plow layer is dark reddish-brown loam about 8 inches thick. Directly beneath this is a friable reddish-brown loam about 5 inches thick. The upper part of the subsoil is reddish-brown heavy silt loam about 6 inches thick. The lower part of the subsoil is dark-red, very firm silty clay loam 57 inches thick. The substratum is dark reddish-brown shaly loam about 7 inches thick. Hard bedrock is at a depth of about 83 inches.

Permeability is slow. Available water capacity is high, natural fertility is moderate, and natural reaction is strongly acid.

Extensive, formerly cleared areas are now idle and reverting to trees. Small areas are used for corn, small grain, hay, and pasture. Tillage is delayed in places by excess water above the firm subsoil, but water does not remain in the profile for long periods. Control of erosion is needed.

Representative profile of Norton loam, 2 to 6 percent slopes, in a formerly cultivated field along New Bromley Road, 3.1 miles south of Route 523:

Ap—0 to 8 inches, dark reddish-brown (5YR 3/4) loam; weak, fine, granular structure; friable; many fine and medium roots; slightly acid; abrupt, smooth boundary.

A2—8 to 13 inches, reddish-brown (5YR 4/4) loam; weak, medium, subangular blocky structure; friable; common fine and medium roots; few, scattered, rounded quartzose pebbles; medium acid; clear, wavy boundary.

B1—13 to 19 inches, reddish-brown (5YR 4/4) heavy silt loam; moderate, medium, subangular blocky structure; slightly firm; few medium roots; 3 percent small quartzose, shale, or gneissic pebbles; medium acid; gradual, wavy boundary.

B21t—19 to 41 inches, dark-red (2.5YR 3/6) heavy silty clay loam; strong, medium, angular and subangular blocky structure; very firm; thick, continuous, shiny coatings on faces of peds; 5 percent shale fragments and rounded gneiss and quartzose pebbles; strongly acid; diffuse, wavy boundary.

B22t—41 to 76 inches, dark-red (25YR 3/6) silty clay loam; moderate, medium, subangular blocky structure; very firm; thin, continuous, shiny coatings on faces of some peds; 8 percent rounded gneiss, quartzose, and shale fragments; strongly acid; diffuse, wavy boundary.

IIC—76 to 83 inches, dark reddish-brown (2.5YR 3/4) shaly loam; massive; 20 percent highly fractured red shale that has inherited rock structure; horizontal parting surfaces of shale fragments, generally are silt and clay filmed; strongly acid to slightly acid, depending on the stratum; gradual, irregular boundary.

R—83 inches, hard red shale bedrock.

The solum ranges from 40 to 80 inches in thickness. Depth to bedrock is 4 to 10 feet or more. Content of coarse fragments is 2 to 15 percent in the A and B horizons and as much as 20 percent in the stratum of some C horizons. The B horizon hue generally is 2.5YR but ranges to 5YR, value is 3 or 4, and chroma ranges from 4 to 6. Texture of the B2 horizon is clay loam and silty clay loam. The IIC horizon hue normally is 2.5YR but ranges to 10R. Value ranges from 3 to 5 in this horizon and chroma from 3 to 6. The texture normally is silty clay loam but ranges from clay loam to loam. Generally this horizon is within a depth of 60 inches, but in places it is as deep as 80 inches.

Coarse fragments of quartzite, shale, and gneiss are present throughout the profile. The shale content normally increases with depth.

Norton soils adjoin Penn, Reaville, and Lansdowne soils and grade toward them. They are much deeper to bedrock than Penn soils. They are deeper to bedrock and lack the mottling characteristic of Reaville soils. They lack the gray mottling of Lansdowne soils.

Norton loam, 2 to 6 percent slopes (NoB).—This soil has the profile described as representative for the series. Content of organic matter is medium, and the soil is easy to till. Runoff is moderate.

Small areas of somewhat poorly drained Lansdowne soils are included with this soil in mapping. Also included, on terraces, are areas of loamy soils that have a fragipan in the subsoil.

If this soil is farmed, it is moderately erodible. Conservation practices that control runoff can be used to help reduce the amount of soil loss. Capability unit IIe–51; woodland group 3o1.

Norton loam, 6 to 12 percent slopes, eroded (NoC2).—This soil is similar to the one described as representative for the series, except that erosion has thinned the surface layer, and the subsoil is mixed into the plow layer or is completely exposed in places. Shallow gullies are common. Included in mapping are some areas that are wooded and not eroded, many small areas where the depth to bedrock is less than 40 inches, and a few areas of a soil that has a fragipan.

Runoff is rapid, and the erosion hazard is moderately severe. Tillage is difficult because the plow layer is low in content of organic matter and somewhat clayey. Cover crops, contour stripcropping, diversion terraces, and cropping systems that include sod can be used to reduce the hazard of further erosion. Capability unit IIIe–51; woodland group 3o1.

Norton loam, 12 to 18 percent slopes, eroded (NoD2).—This soil is similar to the one described as representative for the series, except that erosion has thinned the original surface layer, and the original subsoil is exposed or material from it is mixed into the plow layer. Included in mapping are very small areas where slopes are greater than 18 percent and some areas that are wooded and not eroded. Many small areas where depth to bedrock is less than 40 inches are included. In many fields shallow gullies are common.

Because of the moderately steep slopes, rapid runoff, and severe hazard of further erosion, this soil is poorly suited to row crops. It is better suited to small grain, hay, and pasture. Capability unit IVe–55; woodland group 3o1.

Parker Series

The Parker series consists of deep, gently sloping to steep, somewhat excessively drained, gravelly or cobbly soils that formed in material weathered from granite gneiss. They occur on uplands and are underlain by gneiss bedrock.

In a representative profile the plow layer is dark-brown cobbly loam about 9 inches thick; and the subsoil is yellowish-brown, friable, cobbly sandy loam about 13 inches thick. The substratum is yellowish-brown, loose, cobbly sandy loam; and it is about 50 percent or more coarse fragments. Weathered bedrock is at a depth of about 41 inches.

Permeability is moderately rapid in the surface layer and subsoil and rapid in the substratum. Available water capacity is low, fertility is moderate to low, and natural reaction is strongly acid. Fields that have been limed for long periods are not so acid.

Extensive areas of Parker soils have been cleared and are used for farming. Cleared areas on steep slopes require erosion control. The many stones and pebbles make seedbed preparation fairly difficult. These soils are only fairly well suited to hay and pasture because they are droughty. In areas where stones have been removed, or in fields that are naturally less cobbly, corn and small grain are grown.

Representative profile of Parker cobbly loam, 3 to 15 percent slopes, along the east side of Philhower Road, 1 mile south of Califon, and 0.3 mile south of Sutton Road:

Ap—0 to 9 inches, dark-brown (10YR 3/3) cobbly loam; weak, very fine, granular structure; very friable; many fine and medium roots; 35 percent angular gneissic gravel and cobblestones 3 to 5 inches in diameter; medium acid; abrupt, smooth boundary.

B—9 to 22 inches, yellowish-brown (10YR 5/6) cobbly sandy loam; weak, medium, subangular blocky structure breaking to structureless; single grain; friable; many medium and coarse roots; organic stains on faces of some peds; patchy clay bridging barely evident between sand grains; 40 percent angular gneissic cobblestones 3 to 6 inches in diameter; strongly acid; diffuse, wavy boundary.

C—22 to 41 inches, yellowish-brown (10YR 5/8) cobbly sandy loam; massive; loose; 50 percent gneissic rock fragments increasing with depth; strongly acid.

R—41 inches, extremely weathered and fractured gneissic bedrock.

The solum ranges from 20 to 30 inches in thickness. Depth to bedrock ranges from about 3½ to 6 feet or more. The solum is 35 to 60 percent coarse fragments, and the C horizon is 50 percent or more. In the Ap horizon hue is 10YR, and the value and chroma are 3 or 4. The B horizon has a dominant hue of 10YR but ranges to 7.5YR. Value is 4 or 5, and chroma ranges from 4 to 6. The texture is commonly cobbly sandy loam, cobbly loam, or their very cobbly analogs.

Parker soils adjoin Edneyville, Califon, and Annandale soils and grade toward them. They are steeper and at a higher elevation than the less cobbly, more clayey, very firm, well-drained Annandale soils. Parker and Edneyville soils occupy similar positions in the landscape, but Edneyville soils are slightly more clayey and much less cobbly throughout the entire profile.

Parker cobbly loam, 3 to 15 percent slopes (PaC).—This soil has the profile described as representative for the series. Included in mapping are areas where erosion has thinned the original surface layer several inches and the upper part of the subsoil is mixed with the plow layer. Small areas of Edneyville very gravelly loam are also included. Shallow gullies are common. In places the surface layer is very cobbly.

The large number of cobblestones in the soil make it difficult to cultivate (fig. 11). This soil is better suited to hay or pasture than to other crops. Capability unit IVs–60; woodland group 3f1.

Figure 11.—Parker cobbly loam. Plowing, cultivating, and harvesting are difficult because of the cobblestones.

Parker cobbly loam, 15 to 25 percent slopes (PaD).—Included in mapping are areas where erosion has thinned the original surface layer several inches and material from the upper part of the subsoil is mixed into the plow layer. Shallow gullies are present in some fields.

Because of many cobblestones, steep slopes, low fertility, droughtiness, and the severe erosion hazard, this soil is best suited to hay, pasture, woodland, or wildlife habitat. Capability unit VIs–60; woodland group 3r1.

Pattenburg Series

The Pattenburg series consists of deep, gently sloping to very steep, reddish, well-drained, gravelly soils that formed on uplands in material weathered from reddish quartose conglomerate or fanglomerate.

In a representative profile the plow layer is reddish-brown gravelly loam about 7 inches thick. The upper part of the subsoil is friable, dark-red gravelly loam about 7 inches thick. The lower part is weak-red, friable, gravelly heavy loam about 16 inches thick. The substratum is red gravelly sandy loam about 30 inches thick. Conglomeratic bedrock is at a depth of about 60 inches.

Permeability is moderate in the subsoil and moderately rapid in the substratum. Available water capacity is moderately low, natural fertility is low, and natural reaction is strongly acid, except where fields have been limed.

Most areas of Pattenburg soils are farmed. Trees in wooded areas are mainly oak and hickory. These soils are well suited to corn, small grain, hay, and apples. Control of erosion is needed in cultivated areas.

Representative profile of Pattenburg gravelly loam, 2 to 6 percent slopes, in a pasture along Hamden Road, 0.6 mile west of Allerton Church:

Ap—0 to 7 inches, reddish-brown (2.5YR 4/4) gravelly loam; moderate, fine, granular structure; friable; 15 percent rounded quartzite gravel and cobblestones; strongly acid; clear, smooth boundary.

B1—7 to 14 inches, dark-red (2.5YR 3/6) gravelly loam; moderate, fine, subangular blocky structure; friable; 20 percent rounded quartzite gravel and cobblestones; strongly acid; gradual, smooth boundary.

B2t—14 to 30 inches, weak-red (10R 4/4) gravelly heavy loam; strong, fine, subangular blocky structure; friable; continuous thin clay films on faces of peds; 40 percent rounded quartzite gravel and cobblestones; strongly acid; clear, wavy boundary.

C—30 to 60 inches, red (2.5YR 4/6) gravelly sandy loam; massive; friable; 45 percent quartzite gravel and cobblestones; gravel content and size increase with depth; strongly acid.

R—60 inches, dark reddish-brown (5YR 3/4) sandy shale conglomerate; many quartzite pebbles and cobblestones.

The solum ranges from 26 to 36 inches in thickness. Depth to hard bedrock is 3½ to 8 feet. Thin calcareous rock strata are in some profiles. Coarse fragments range from 15 to 40 percent in the A horizon, 20 to 40 percent in the B horizon, and 35 to 75 percent in the C horizon. Rounded but fractured quartzite gravel makes up most of the coarse fragments, but there are small amounts of shale and sandstone in places.

The AP horizon ranges from dark brown (7.5YR 4/2) to reddish brown (2.5YR 4/4). The B2 horizon ranges from reddish brown (5YR 3/3) to weak red (10R 4/4). Texture in this horizon ranges from gravelly loam to gravelly clay loam. The structure is typically weak or moderate subangular blocky, and consistence ranges from friable to slightly firm. The C horizon color ranges from dusky red (2.5YR 3/2) to red (2.5YR 4/6), and texture ranges from gravelly or very gravelly sandy loam to gravelly or very gravelly loam.

Pattenburg soils adjoin Edneyville, Duffield, and Washington soils. They are less clayey and much redder than Edneyville soils. They are much less clayey and contain many more coarse fragments than Duffield or Washington soils.

Pattenburg gravelly loam, 2 to 6 percent slopes (PbB).—This soil has the profile described as representative for the series. A few small areas that have seepage spots and mottled soils are included with this soil in mapping. Also included are farmed areas that are eroded and, near New Amsterdam, small areas of a more sandy soil. Gullies are in some fields.

This soil is suited to corn, small grain, soybeans, hay, and pasture. Stripcropping is used on long slopes to reduce the erosion hazard. Capability unit IIe–58; woodland group 2o1.

Pattenburg gravelly loam, 6 to 12 percent slopes, eroded (PbC2).—This soil is similar to the one described as representative for the series, except that it contains more gravel. A few spots of less sloping soils and some areas of steeper soils have been included in mapping. Also included are areas where bedrock is at a depth of less than 42 inches.

Runoff is rapid, and the erosion hazard is moderately severe. Most areas of this soil are wooded. Many areas have been used for individual residences. The soil is suited to corn, small grain, soybeans, hay, and pasture. Contour stripcropping and diversion terraces are used to prevent further erosion in cultivated fields. Capability unit IIIe–58; woodland group 2o1.

Pattenburg gravelly loam, 12 to 18 percent slopes (PbD).—This soil has a profile similar to the one described as representative for the series, except that the content of gravel in the surface layer generally exceeds 35 percent. Shallow gullies are common.

Included with this soil in mapping are a few small areas of steeper and less sloping soils, a few areas where soils are shallower over bedrock, some areas of severely eroded soils, and small areas of Penn soils that grade toward this soil. Also included are a few small areas where the surface layer and the heavier subsoil have both been removed, and the very gravelly and sandy substratum is exposed.

Moderately steep slopes, rapid runoff, severe erodibility, and the gravel content of the soil limit use. It is better suited to pasture and hay or to trees and wildlife habitat than to other uses. Capability unit IVe–58; woodland group 2o1.

Pattenburg gravelly loam, 18 to 40 percent slopes (PbE).—This soil has a profile similar to the one described as representative for the series, except that the surface layer and subsoil are thinner, the contrast in texture between horizons is less pronounced, and the texture of the surface layer and subsoil is a little coarser. A few rocks crop out of this soil. A few small areas of less sloping soils are included in mapping.

Steep slopes, rapid runoff, severe erodibility, and the gravel content of this soil make it better suited to pasture, hay, trees, or wildlife habitat than to most other uses. Capability unit VIIe–60; woodland group 2r1.

Pattenburg gravelly loam, moderately wet, 2 to 6 percent slopes (PcB).—The profile of this soil is similar to the one described as representatives for the series, except that mottles are in the lower part of the subsoil. Also, this soil becomes saturated late in winter and early in spring, and it dries slowly in spring. Included in mapping are many small areas of soils where gray mottles occur in the upper 20 inches and a very few areas where mottles are dominantly gray throughout. Also included are small areas of nearly level soils and small areas where slopes are more than 6 percent. These steeper soils have some shallow gullies.

If the soil is properly drained, such crops as corn, small grains, soybeans, and mixed grasses for hay and pasture are suitable. Runoff is medium, and the erosion hazard is moderate. Graded stripcropping supplemented with diversion terraces and grassed waterways are used to dispose of excess surface water and to control erosion. Capability unit IIe–71; woodland group 2w1.

Penn Series

The Penn series consists of moderately deep, gently sloping to moderately steep, well-drained, loamy soil that formed over red shale or siltstone on uplands.

In a representative profile the plow layer is reddish-brown shaly silt loam about 9 inches thick. Beneath this is a friable, reddish-brown, shaly silt loam subsoil 13 inches thick. It becomes more shaly as depth increases. The substratum is very shaly loam about 8 inches thick. Bedrock is at a depth of about 30 inches.

Permeability is moderate to moderately rapid in the surface layer and subsoil. Available water capacity is moderate to high depending on the depth to bedrock and the content of shale. Natural fertility is moderate. Natural reaction is strongly acid, but fields that have been limed over a long period are not so acid.

Most areas of these Penn soils have been cleared for farming. Many areas of the more sloping soils are wooded. Cleared areas require erosion control. In places, late in winter and early in spring, the lowest part of the subsoil is saturated, and water flows laterally over the surface of the bedrock. Water seeps into cellars during these periods.

Representative profile of Penn shaly silt loam, 2 to 6 percent slopes, on Wertsville Road, 1.5 miles east of Ringoes and 150 feet south of the road:

Ap—0 to 9 inches, reddish-brown (5YR 4/3) shaly silt loam; moderate, fine, subangular blocky structure; friable; many fine and medium roots; 20 percent angular shale fragments; medium acid; clear, smooth boundary.

Bt—9 to 22 inches, reddish-brown (2.5YR 4/4) slightly clayey shaly silt loam; weak, medium, subangular blocky structure; friable; few medium roots; few thin clay films on faces of peds; 20 percent angular shale fragments; medium acid; clear, smooth boundary.

C—22 to 30 inches, reddish-brown (2YR 5/4) very shaly loam; massive; friable; more than 50 percent shale fragments; medium acid; abrupt, smooth boundary.

R—30 inches, shattered shale bedrock.

The solum ranges in thickness from 20 to 36 inches but generally is less than 24 inches. Depth to bedrock ranges from 20 to 40 inches but generally is less than 30 inches. Content of coarse fragments averages 15 to 30 percent in the A horizon, 20 to 50 percent in the B horizon, and 50 percent or more in the C horizon. The Ap horizon has a hue of 5YR and a value and chroma of 2 to 4. In the Bt horizon the hue is 2.5YR or 5YR, and the value and chroma are 3 or 4. The texture in this horizon ranges from shaly heavy silt loam to shaly heavy loam. Reaction ranges from strongly acid to slightly acid in the C horizon. In the southern part of the county, this soil has a somewhat thinner solum and is shallower to rock than that described in the representative profile for the series.

Penn soils adjoin Bucks, Reaville, and Readington soils and grade toward them. They lack the mottling characteristic of Reaville and Readington soils and are not so deep as Bucks soils.

Penn shaly silt loam, 2 to 6 percent slopes (PeB).—This soil has the profile described as representative for the series. Included in mapping are small areas of nearly level soils that have material eroded from adjoining slopes deposited on their surface. Here the surface layer is unusually thick, and the depth to bedrock exceeds that of the representative profile. Areas of soil that is less than 15 percent shale fragments in the surface layer are included. Also included are small areas of Bucks and Klinesville soils where shallow gullies are common, small areas where the soil is only 16 to 20 inches deep over bedrock, and small areas of moderately well drained, mottled Readington soils. In the northern part of the county, areas are included where the soil has a surface layer of loam that generally has quartzite pebbles in addition to the sandy shale fragments.

Corn, small grain, alfalfa, and grasses are the most suitable crops. Capability unit IIe–65; woodland group 3o1.

Penn shaly silt loam, 6 to 12 percent slopes, eroded (PeC2).—This soil is similar to the one described as representative for the series, except that as a result of erosion it is shallower to shale bedrock. Runoff is rapid on the stronger slopes, and shallow gullies are common.

Included with this soil in mapping are a few areas where the surface layer is less than 15 percent shale fragments. Also included are areas where the surface layer is loam that generally has quartzite pebbles in addition to the sandy shale fragments. Such areas are located in the northern part of the county where Pattenburg soils are associated with this soil. In those areas the bedrock is likely to have

strata of free lime closer to the surface than those of the Penn soils in the southern part of the county.

A moderately severe hazard of further erosion, the low content of organic matter, and the moderate depth to bedrock limit the use of this soil. Intensive conservation measures should be used where row crops are grown. Capability unit IIIe–65; woodland group 3o1.

Penn shaly silt loam, 12 to 18 percent slopes (PeD).—This soil is similar to the one described as representative for the series, except that as a result of erosion it is shallower to bedrock, and the content of shale is greater. Included in mapping, in the northern part of the county, are areas where the surface layer is loam that contains quartzite pebbles in addition to the sandy shale fragments. In these areas the bedrock is likely to have strata of free lime closer to the surface than those of the Penn soils in the southern part of the county.

Runoff is rapid, and the erosion hazard is severe because of the moderately steep slopes. Gullies are common. The content of organic matter is extremely low. This soil is not well suited to row crops. It is better suited to drought-resistant grasses and legumes grown for hay and pasture. Capability unit IVe–65; woodland group 3o1.

Penn-Bucks complex, 2 to 6 percent slopes (PfB).—This mapping unit is about 50 percent moderately deep Penn soil and 50 percent deep Bucks soil. Each of these soils is similar to the one described as representative for its series, except that in many areas the Penn soil is less than 15 percent shale in the surface layer. These soils are too intermingled to map separately. They are gently undulating. The Penn soil is on very low knolls, 1 to 2 feet in height, on the broad uplands. Bucks soil is in the shallow troughs between the knolls.

Included with these soils in mapping are small areas of Readington and Reaville soils.

Crops commonly grown on these soils are corn, small grain, hay, and pasture. On long slopes in cultivated fields, stripcropping and diversion terraces can be used to conserve moisture and to protect these soils from erosion. Capability unit IIe–65; woodland group 3o1.

Penn-Bucks complex, 6 to 12 percent slopes, eroded (PfC2).—This mapping unit is about 70 percent moderately deep Penn soil and 30 percent deep Bucks soil. Each of these soils has a profile similar to the one described as representative for its series, except that the Penn soil has so little shale that the surface layer is dominantly silt loam. They occur together in fairly large areas and on long, moderate slopes. Shallow gullies are common.

This complex is characterized by uneven depths to bedrock. The depth to bedrock in Penn soil ranges from 1½ to 3½ feet, but in Bucks soil it ranges from 3½ to 5 feet. Rapid runoff and the moderately severe erosion hazard limit the use of these soils. Farmed areas need intense conservation practices that control erosion, Capability unit IIIe–65; woodland group 3o1.

Pope Series

The Pope series consists of deep, nearly level, well-drained soils that formed in alluvium. They are adjacent to the Delaware River on low terraces that are subject to overflow about once every 5 years.

In a representative profile the plow layer is dark-brown fine sandy loam about 12 inches thick. The subsoil is friable, brown fine sandy loam 18 inches thick. The upper part of the substratum is brown light sandy loam 16 inches thick. This grades to the loose, dark-brown gravelly sandy loam lower part of the substratum, which is 14 inches thick.

Permeability is moderately rapid in the surface layer and subsoil and rapid in the substratum. Available water capacity is moderate. Natural fertility is low. Natural reaction is medium acid or slightly acid, but fields that have been limed over a long period are not so acid.

Most areas of these Pope soils have been cleared for farming. Because of their sandy nature, lime and fertilizers leach easily. The soils can be worked easily and early and are suited to a wide variety of vegetables. Irrigation is beneficial to high-value crops.

Representative profile of Pope fine sandy loam, high bottom, along the north side of State Highway 29 (River Road), 1.5 miles northwest of Stockton:

Ap—0 to 12 inches, dark-brown (10YR 4/3) fine sandy loam; very weak, fine, granular structure parting easily to single grain; very friable; many fine roots; medium acid; abrupt, smooth boundary.

B—12 to 30 inches, brown (7. 5YR 4/4) fine sandy loam; weak, fine, granular structure; friable; few medium roots; very weak clay bridging of sand grains; medium acid; diffuse, wavy boundary.

C1—30 to 46 inches, brown (7.5YR 4/4) light sandy loam; massive; very friable; slightly acid; diffuse, wavy boundary.

IIC2—46 to 60 inches, dark-brown (7.5YR 4/4) gravelly sandy loam; massive; loose; 35 percent rounded quartzose gravel; slightly acid.

The solum ranges from 20 to 30 inches in thickness. Depth to the IIC horizon is more than 40 inches. Depth to bedrock exceeds 6 feet. A few rounded coarse fragments are in the soil to a depth of 40 inches. The gravel is mostly hard quartzose; but in places coarse fragments of red shale, red sandstone, gneiss, diabase, argillite, and limestone are present. Coarse fragments in the IIC horizon range from 20 to 80 percent.

The Ap horizon has a hue of 10YR, a value of 4 or 5, and a chroma of 3 or 4. In the B horizon the hue is commonly 7.5YR but ranges to 5Y, value is 4 or 5, and chroma is 2 to 4. No mottling is present to a depth of 24 inches, but in places color banding or weak variegations are below that depth. Texture of the B horizon generally is fine sandy loam but ranges to loam. The C horizon generally has a hue of 7.5YR, but it ranges to 10YR. In some profiles, variegated colors occur in this horizon. The texture ranges from gravelly sandy loam to gravelly loamy sand. Thin, finer textured bands or lenses are common in the profile; but the sum of their thicknesses, to a depth of 72 inches, does not exceed 6 inches.

Pope soils occur as a narrow band along the Delaware River, from Warren County to Mercer County. They adjoin Riverhead soils but are in a lower position. They are less gravelly than Riverhead soils.

Pope soils in this county have a higher reaction in the lower part than is normal for the series. This, however, does not alter their usefulness or behavior.

Pope fine sandy loam, high bottom (Pk).—This is the only Pope soil mapped in the county. Slopes are mostly 0 to 2 percent, but in places they are as much as 6 percent.

Included in mapping are soils that have a redder subsoil than that of this soil and a few areas of soils that have a gravelly sandy loam surface layer. Also included, in places, are soils that are shallower than 40 inches over the very gravelly substratum and a few low areas immediately adjacent to the river or on islands within the river. The latter areas are flooded annually.

Runoff is slow and erosion is slight. This soil is suited to a wide variety of vegetables. Irrigation is beneficial to

high-value crops. Erosion on short slopes can be controlled by ordinary good management. On long slopes, contour stripcropping is used to control runoff and erosion. Flooding of the soils by the Delaware River is infrequent, ranging from once in 3 years to once in 20 or 30 years. A few areas are flooded less frequently. Capability unit I–57; woodland group 1o1.

Quakertown Series

The Quakertown series consists of deep, nearly level to moderately steep, well-drained soils that formed in material weathered from silty sandstone. In places the sandstone is interbedded with argillite.

In a representative profile the surface and subsurface layers generally are dark-brown silt loam and have a combined thickness of about 12 inches. The subsoil is dark-brown silt loam or silty clay loam about 24 inches thick. It contains some very small, flat, sandstone fragments. The substratum is firm, dark-brown clay loam about 20 inches thick, and it has many rock fragments. Sandstone bedrock is at a depth of about 56 inches.

Permeability is moderate in the surface layer and moderately slow in the subsoil. Available water capacity is high. Natural fertility is moderate. Natural reaction is strongly acid, but in fields that have been limed for a long time, reaction is not so acid throughout the profile.

Most areas of Quakertown soils have been cleared for farming. The soils are suited to corn, small grain, hay, and pasture. The gently sloping to moderately steep soils under cultivation require erosion control.

Representative profile of Quakertown silt loam, 2 to 6 percent slopes, in a cultivated field, along the south side of road, 0.25 mile west of Allens Corner:

Ap—0 to 8 inches, dark-brown (10YR 3/3) silt loam; moderate, medium and coarse, granular structure; friable, many fine roots; 2 percent shale fragments; medium acid; abrupt, smooth boundary.

A2—8 to 12 inches, dark-brown (10YR 4/3) silt loam; very weak, very thick, platy structure parting to moderate, fine, subangular blocky; friable; many coarse and medium roots; 5 percent shale fragments; medium acid; clear, wavy boundary.

B1—12 to 20 inches, dark-brown (7.5YR 4/4) silt loam; weak to moderate, medium, subangular blocky structure; friable; many coarse roots; 5 percent shale fragments; medium acid; clear, wavy boundary.

B21t—20 to 29 inches, light silty clay loam, dark-brown (7.5YR 4/4) interiors of peds and strong-brown (7.5YR 5/6) faces; moderate, coarse and medium, subangular blocky structure; firm; thin, discontinuous, slightly shiny, redder clay films on faces of peds; 6 percent shale fragments as much as 8 inches in diameter; very few roots; strongly acid; gradual, wavy boundary.

B22t—29 to 36 inches, silty clay loam, dark-brown (7.5YR 4/4) interior of peds and strong-brown (7.5YR 5/6) faces; moderate, coarse and medium, subangular blocky structure; firm; thick, continuous, redder clay films on faces of peds; 8 percent coarse fragments, as much as 8 inches in diameter; strongly acid; gradual, wavy boundary.

C—36 to 56 inches, dark-brown (7.5YR 4/4) clay loam; massive; firm or very firm, slightly brittle in places; many very weathered rock fragments, less weathered and more numerous as depth increases; strongly acid.

R—56 inches, fractured silty sandstone.

The solum ranges from 25 to 36 inches in thickness. Depth to bedrock is 3½ to 6 feet or more. Coarse fragments consist of weathered, dominantly fine-grained sandstone; but siltstone and argillite fragments are also present. These fragments make up 2 to 30 percent of the A and B horizons and 20 to 70 percent of the C horizon. The Ap horizon has a hue of 10YR or 7.5YR, value of 3 or 4, and a chroma of 3. In the B horizon hue is 7.5YR, value is 4 or 5, and chroma is 3 to 6. Texture of the B and C horizons ranges from heavy loam to silty clay loam and their channery analogs.

Quakertown soils adjoin Chalfont, Croton, and Lehigh soils and grade toward them. They are less firm in the upper part of the B horizon than the distinctly mottled, somewhat poorly drained Chalfont soils. In contrast to Quakertown soils, the gray-surfaced, poorly drained Croton soils, which occupy low positions in the landscape, have gray mottles throughout their solum. Quakertown soils differ from Lehigh soils in that they are not mottled and did not form in material weathered from gray shale.

Quakertown silt loam, 0 to 2 percent slopes (QkA).—This nearly level soil has a slightly thicker surface layer than the soil described as representative for the series. Included in mapping are areas of Chalfont and Lehigh soils that are too small to map separately. Also included are a few small areas of moderately well drained soils that are similar to this soil except for faint mottling. The latter soils dry somewhat slower in spring but are not wet enough to require drainage.

Corn, small grain, grasses, and soybeans are the common crops grown on this soil. Capability unit I–55; woodland group 2o1.

Quakertown silt loam, 2 to 6 percent slopes (QkB).—This soil has the profile described as representative for the series. Included in mapping are small areas of soils where slopes are less than 2 percent and areas of Chalfont or Lehigh soils too small to be mapped separately. A few small areas of moderately well drained soils similar to this soil, but with faint mottling, are also included. In addition, farmed areas of eroded soils are included. Gullies are in some fields.

Corn, small grain, hay, and pasture are suitable crops. On long slopes contour stripcropping is used to reduce runoff and erosion. Capability unit IIe–55; woodland group 2o1.

Quakertown silt loam, 6 to 12 percent slopes, eroded (QkC2).—This soil has a profile similar to the one described as representative for the series, except that erosion has thinned the original surface layer, and material from the subsoil is mixed with the plow layer or the original subsoil is now exposed. Shallow gullies are common. Included in mapping are small areas where erosion has removed all of the original surface layer. Wooded areas of uneroded soil that has never been farmed are also included.

Runoff is rapid, and the erosion hazard is moderately severe. Cover crops, contour stripcropping, diversion terraces, and cropping systems that include sod are used to reduce the hazard of further erosion. Capability unit IIIe–55; woodland group 2o1.

Quakertown silt loam, 12 to 18 percent slopes, eroded (QkD2).—This soil is similar to the one described as representative for the series, except that it has lost all or most of its original surface layer. Shallow gullies are common. Some areas included in mapping have a channery silt loam surface layer.

Rapid runoff, severe erodibility, and steep slopes limit the use of this soil. It is poorly suited to continuous row crops, but such crops are grown occasionally in a cropping system that includes small grain or hay. Capability unit IVe–55; woodland group 2o1.

Quakertown-Chalfont silt loams, 6 to 12 percent slopes, eroded (QlC2).—Each of the two soils in this mapping unit is similar, but somewhat thinner because of erosion, to the soil described as representative for its respective series. Areas of these soils are too intermingled to be mapped separately. Quakertown soil makes up to 65 percent of this mapping unit, and most of the rest is Chalfont soil. In some areas, however, the Chalfont soil is dominant. Quakertown soil occupies higher positions in the landscape than Chalfont soil. Shallow gullies are common.

Wetness of the less extensive but somewhat poorly drained Chalfont soil limits the use of the soils in this mapping unit and controls the timing of field operations. A moderately high water table in the Chalfont soil prevents the use of machinery on it for some time after the Quakertown soil is ready to plow.

Rapid runoff on these sloping soils causes a moderately severe erosion hazard in cultivated fields. Graded stripcropping supplemented by diversion terraces and grassed waterways is used to control runoff and erosion. Open ditches are used to dispose of excess water. Capability unit IIIe–70; woodland group 2o1.

Raritan Series

The Raritan soils are deep, nearly level to gently sloping, and moderately well drained to somewhat poorly drained. These soils formed in deposits of old alluvium derived from material weathered mainly from shale and sandstone. They are on stream terraces above the flood plain. Where these soils are on low terraces along streams in the southern half of the county, stream overflow occurs less than 1 year in 5.

In a representative profile, in a cultivated field, the plow layer is brown silt loam about 13 inches thick. The upper part of the subsoil, about 11 inches thick, is light reddish-brown and reddish-brown, mottled silt loam. The lower part is firm, reddish-brown, mottled light clay loam 20 inches thick. The substratum is dark reddish-brown stratified silt loam, sand, and gravel that has pinkish-gray and brownish-yellow mottles.

Raritan soils have moderately slow permeability. The sandy or gravelly substratum is moderately rapidly permeable. Natural fertility is moderate. The available water capacity is high. Natural reaction is medium acid to strongly acid, but limed fields are not so acid.

These soils contain excessive water in winter and in spring. If drained, they are suited to the commonly grown farm crops, such as corn, small grain, hay, and pasture. Control of erosion is needed, especially in areas of gently sloping soils.

Representative profile of Raritan silt loam, 0 to 2 percent slopes, in a cultivated field in Franklin Township, north of road to Lansdowne and 600 feet west of County Road No. 2:

Ap—0 to 13 inches, brown (7.5YR 4/2) silt loam; weak, fine and medium, granular structure; very friable; many fine roots; 5 percent rounded pebbles; medium acid; abrupt, smooth boundary.

B1—13 to 18 inches, light reddish-brown (5YR 6/4) silt loam; weak, fine, granular structure; friable; common fine roots; 5 percent rounded pebbles; medium acid; clear, wavy boundary.

B2t—18 to 24 inches, reddish-brown (5YR 5/4) heavy silt loam; common, fine, distinct, pinkish-gray (5YR 6/2) and brown (7.5YR 5/4) mottles; moderate, medium, subangular blocky structure; friable; few fine roots; common moderately thick clay films on faces of peds and in root channels; 5 percent rounded pebbles; strongly acid; clear, wavy boundary.

Bx1—24 to 40 inches, reddish-brown (2.5YR 4/4) light clay loam; many, medium, distinct, light-gray (7.5YR 7/1) and pinkish-gray (5YR 7/2) mottles on faces of peds and a few, fine, distinct, brownish-yellow (10YR 6/6) mottles in interiors; moderate, coarse, prismatic structure parting to moderate, medium angular blocky and moderate, medium, platy; firm, compact, and brittle; few fine roots between peds; common moderately thick clay films on faces of peds; 10 percent rounded pebbles; strongly acid; gradual, wavy boundary.

Bx2—40 to 44 inches, reddish-brown (2.5YR 4/4) heavy loam; common, medium, distinct, pinkish-gray (5YR 7/2) mottles on prisms; weak, coarse, prismatic structure; firm, compact, and brittle; 10 percent rounded fine pebbles; strongly acid; clear, wavy boundary.

IIC—44 to 60 inches, dark reddish-brown (5YR 3/4), pinkish-gray (5YR 7/2), and brownish-yellow (10YR 6/6) stratified horizons of silt loam; fine and coarse sand and gravel; strongly acid.

The solum ranges from 42 to 56 inches in thickness. Depth to the fragipan ranges from 20 to 30 inches. Depth to bedrock is 5 to 7 feet or more. Coarse fragments make up 5 to 15 percent of the solum and 10 to 80 percent of the C horizon. Reaction ranges from slightly acid or medium acid in the Ap horizon to strongly acid in the Bt and Bx horizons. The A horizon has a hue of 7.5YR or 10YR, a value of 4 or 5, and a chroma of 2 to 4. Texture is dominantly silt loam but ranges to loam.

The Bt horizon has a hue of 2.5YR to 7.5YR, a value of 4 to 6, and a chroma of 4 or 5. Texture is heavy silt loam, heavy loam, or clay loam. The depth of mottles of low chroma ranges from 15 to 25 inches.

The Bx horizon has a hue ranging from 2.5YR to 7.5YR, a value of 4 or 5, and a chroma of 4 or 5. Mottles have a value of 5 to 7 and a chroma of 1 to 6. The fragipan commonly is light clay loam, but in places it is heavy loam or silt loam.

The IIC horizon has a hue of 10R to 7.5YR, a value of 3 to 6, and a chroma of 2 to 6. Texture of the stratified material in the substratum is silt loam, fine to coarse sand, and fine to coarse gravel.

Raritan soils adjoin Birdsboro soils on stream terraces that are above the areas of normal overflow. They can be distinguished from Birdsboro soils by their motties. On the flood plain at lower elevations, Raritan soils are associated with Rowland and Bowmansville soils, which are subject to frequent overflow.

Raritan silt loam, 0 to 2 percent slopes (RbA).—This soil has the profile described as representative for the series. Included in mapping are a few areas in which the very firm fragipan is higher in the profile. Other minor inclusions are soils that have a sandy or gravelly substratum within a depth of 40 inches and still others that have a subsoil of sandy loam or have a little less clay in their subsoil. The variation in this soil from place to place is related to differences in the deposits of alluvium in which they formed and to the reach of each particular stream.

Runoff is slow, and the erosion hazard is slight. The principal limitation is a moderately high water table in winter and early in spring. If drained, this soil is moderately well suited to corn, soybeans, spring-sown small grain, hay, and pasture. Generally, wetness makes it poorly suited to alfalfa and winter small grain. Disposal of the excess water is of major concern where this soil is farmed.

In some places this soil is flooded by streams only about once in 50 years, but the flooding hazard varies with each stream and with its location in the watershed. Areas near

stream confluences are particularly susceptible to flooding. Capability unit IIw–71; woodland group 3w1.

Raritan silt loam, 2 to 6 percent slopes (RbB).—This soil is similar to the one described as representative for the series, but in a few areas it has a fragipan that occurs higher in the profile. Included in mapping are soils that have a sandy or gravelly substratum at a depth of less than 40 inches. The considerable variation in this soil is related to differences in the source of parent material.

In cultivated areas graded stripcropping supplemented by diversion terraces and grassed waterways is used to control erosion and manage the water. Capability unit IIe–71; woodland group 3w1.

Readington Series

The Readington series consists of deep, gently sloping to sloping, moderately well drained silt loams on uplands. They generally formed over shale or siltstone bedrock. These soils have a dense fragipan in the lower part of the subsoil that restricts root penetration and the movement of water.

In a representative profile, in a cultivated field, the plow layer is dark-brown silt loam 7 inches thick. The upper part of the subsoil is brown silt loam about 7 inches thick. The middle part is dark-red silt loam that has common, fine, faint mottles and is 12 inches thick. The lower part of the subsoil is about 20 inches thick and is mottled, reddish-brown silt loam that is very firm and brittle. Red shale bedrock is at a depth of about 46 inches.

Permeability is moderate in the surface layer, moderate to moderately slow in the upper part of the subsoil, and moderately slow in the lower part of the subsoil. Available water capacity is high. Natural fertility is moderate. Natural reaction is medium acid to strongly acid. In places limed fields are less acid.

A perched water table causes saturation in the lower part of the subsoil for short periods. This delays farming operations slightly in spring and somewhat restricts plants to those species that tolerate wetness.

Most areas of Readington soils have been cleared for farming. If drained, these soils are suited to corn, grain, hay, and pasture. Control of erosion is needed.

Representative profile of Readington silt loam, 2 to 6 percent slopes, in Reaville across from the U.S. Geologic Survey Gauging Station:

Ap—0 to 7 inches, dark-brown (7.5YR 4/4) silt loam; strong, fine, granular structure; friable, many roots; medium acid; abrupt, smooth boundary.

B1—7 to 14 inches, brown (7.5YR 5/4) silt loam; weak, fine, subangular blocky structure; friable; many roots; medium acid; clear, smooth boundary.

B2t—14 to 26 inches, dark-red (2.5YR 3/6) heavy silt loam; common, fine, faint, reddish-brown (5YR 5/3) mottles; strong, fine, subangular blocky structure; friable, few roots; thin discontinuous clay films on most ped faces; strongly acid; clear smooth boundary.

Bx—26 to 46 inches, reddish-brown (2.5YR 4/4) silt loam; few, fine, distinct, pinkish-gray (5YR 6/2) mottles on faces of peds; moderate, thin, platy structure; very firm, brittle; thick continuous clay films on faces of peds; 10 percent shale fragments; medium acid.

R—46 inches, red shale bedrock

The solum ranges from 40 to 50 inches in thickness. Depth to the fragipan ranges from 24 to 36 inches, and depth to bedrock ranges from 40 to 60 inches or more. Shale fragments make up 0 to 15 percent of the upper part of the solum, 10 to 25 percent of the lower part, and 30 to 50 percent of the C horizon.

In the Ap horizon hue ranges from 10YR to 5YR, value is 3 or 4, and chroma is 2 to 4. The B horizon has a matrix hue of 7.5YR to 2.5YR, a value of 3 to 5, and a chroma of 4 to 6. Mottling begins at a depth between 14 and 24 inches. Mottles range from faint to distinct in contrast, but no low chromas are in the upper 10 inches of the B2t horizon. The B horizon ranges from heavy silt loam to silty clay loam. In places a C horizon is between the solum and the bedrock. The reaction is less acid immediately above the bedrock or at a depth of 30 to 60 inches.

Readington soils adjoin Abbottstown, Bucks, Penn, and Reaville soils and grade toward them. They occupy intermediate positions in the landscape, but they are slightly lower than the similar but well-drained Bucks soils. Readington soils are higher than the similar, prominently mottled, somewhat poorly drained Abbottstown soils. They are deeper than the unmottled, well-drained, moderately deep Penn soils and the mottled, moderately deep Reaville soils.

Readington silt loam, 2 to 6 percent slopes (RcB).—This soil has the profile described as representative for the series. Included in mapping are areas where slope is less than 2 percent and small areas where it is more than 6 percent. In places scattered shale fragments cover 2 to 10 percent of the surface and are throughout the profile. A few small areas included in mapping have been thinned by erosion, and in places a few shallow gullies are present. A few areas of Abbottstown and Reaville soils are also included. In the northern part of the county, near Spring Mills and Hamden, are areas in which the surface layer is loam that contains scattered quartzite gravel. In these areas the bedrock is sandy shale and is nearer the surface than is typical for this soil.

This soil is suited to corn, soybeans, small grain, mixed hay crops, and pasture. The perched water table is moderately high for short periods in winter. There is a moderate hazard of erosion if this soil is farmed. Capability unit IIe–71; woodland group 3w1.

Readington silt loam, 6 to 12 percent slopes, eroded (RcC2).—This soil is similar to the one described as representative for the series, except that in most places it has been thinned by erosion. Included in mapping are a few small areas of soils where slope is 12 to 18 percent, small areas of somewhat poorly drained Abbottstown silt loam, and some places where shale fragments are scattered on 2 to 10 percent of the surface and throughout the profile. A few areas of more permeable soils that lack a fragipan are also included with this unit.

This soil is moderately well suited to corn, soybeans, wheat, oats, mixed hay crops, and pasture. If farmed, the erosion hazard is moderately severe. Diversion of surface water helps to reduce the hazard of further erosion. Capability unit IIIe–70; woodland group 3w1.

Reaville Series

The Reaville series consists of moderately deep, nearly level to strongly sloping, moderately well drained to somewhat poorly drained soils that are underlain by shale or siltstone bedrock.

In a representative profile, in a cultivated field, the plow layer is reddish-brown silt loam 8 inches thick. The upper part of the subsoil is reddish-brown silt loam about 5 inches thick, and the lower part is reddish-brown silt loam that has distinct or faint mottles and is about 6 inches thick. The substratum is reddish-brown shaly silt loam that also

is distinctly mottled. Reddish-brown weathered red shale bedrock is at a depth of about 23 inches.

Permeability is slow. In places the underlying bedrock restricts the downward movement of water. Available water capacity and natural fertility are moderate. Natural reaction is medium acid or strongly acid, but limed fields are not so acid.

Most areas of Reaville soils have been cleared for farming. In its natural state the subsoil is saturated in winter by water held above the bedrock. This delays farming operations in spring and restricts the species of crops that can be grown to those that tolerate wetness. If these soils are drained, however, they are considered moderately well suited to corn, small grain, soybeans, hay, and pasture. Control of erosion is needed in cultivated areas of sloping to strongly sloping soils.

Representative profile of Reaville silt loam, 2 to 6 percent slopes, along State Highway 12, 0.25 mile east of Baptistown:

Ap—0 to 8 inches, reddish-brown (5YR 4/4) silt loam; weak, medium, granular structure; friable, many fine and medium roots; 10 percent shale fragments; medium acid; smooth boundary.

B1—8 to 13 inches, reddish-brown (5YR 5/4) silt loam; weak, medium and thick, platy structure; friable; many medium and fine roots; 10 percent shale fragments; medium acid; clear, wavy boundary.

B2t—13 to 19 inches, reddish-brown (5YR 5/4) silt loam; common, fine and medium, distinct or faint, pinkish-gray (5YR 7/2), reddish-yellow (5YR 6/8), and yellowish-red (5YR 5/8) mottles; weak, very thick, platy structure parting to moderate, fine, subangular blocky; friable; few medium roots; 10 percent shale fragments; thin, discontinuous, patchy, slightly shiny, redder clay films on faces of most peds; strongly acid; gradual, wavy boundary.

C—19 to 23 inches, reddish-brown (5YR 4/4) shaly silt loam; common, fine and medium, distinct, white (5YR 8/1), pinkish-gray (5YR 7/2), and reddish-yellow (7.5YR 6/8) mottles; massive; firm but not brittle; thick, discontinuous, shiny, redder coatings on parting surfaces; 30 percent shale fragments, increasing with depth; strongly acid; abrupt, wavy boundary.

R—23 inches, reddish-brown (5YR 4/4) weathered red shale bedrock; many pinkish-gray (7.5YR 7/2) silt loam coatings in cracks and shale partings.

The solum ranges from 12 to 20 inches in thickness. Depth to bedrock ranges from 20 to 40 inches. Coarse fragments normally increase in number with depth. They range from 10 to 20 percent in the A horizon, 10 to 35 percent in the B horizon, and from 30 to 70 percent in the C horizon. The B horizon has a hue of 5YR or 2.5YR, a value of 4 or 5, and a chroma of 3 or 4. Low-chroma mottling occurs in places in the upper part of the B horizon and ranges from faint to prominent in the lower part. The texture is silt loam, light silty clay loam, or shaly silt loam. In the C horizon the hue ranges from 5YR to 2.5YR.

Reaville soils adjoin Penn, Readington, and Abbottstown soils and grade toward them. Mottling in the B horizon of Reaville soils distinguishes them from the well-drained Penn soils. Reaville soils are shallower to bedrock than Abbottstown and Readington soils.

Reaville silt loam, 0 to 2 percent slopes (ReA).—This soil has a profile similar to the one described as representative for the series, but in places deposits washed from nearby slopes have made the surface layer thicker. Included in mapping are a few areas where the surface layer is more than 15 percent shale, a few areas of Readington soils, and a few areas where the depth to bedrock is less than 20 inches. Also included are a very few areas of soils of the Reaville series, wet variant.

This soil is suited to corn, soybeans, mixed hay crops, and pasture. Wetness is the major limitation to use, and in spring fieldwork is frequently delayed. Open ditches are used to remove excess water and improve drainage. Diversion of water flowing from steeper slopes helps to prevent surface water from accumulating on this nearly level soil. Capability unit IIIw–70; woodland group 4w1.

Reaville silt loam, 2 to 6 percent slopes (ReB).—This soil has the profile described as representative for the series. Areas that have shallow gullies are included in mapping. Also included are many small areas of soils that are less than 20 inches deep over bedrock and a few that are less than 10 inches deep. In addition a few areas of soils where the slope is less than 1 percent or more than 6 percent are included and areas where the original surface layer has been thinned significantly by erosion.

The soil generally is wet in spring, and plowing and planting are often delayed. The limited depth of this soil causes it to dry out rapidly in summer. It is suited to legumes and grasses that tolerate wetness, such as ladino clover and reed canarygrass. This Reaville soil is poorly suited to small grain and alfalfa. Winter grain is damaged by excess surface water from seeps and springs. In places alfalfa is damaged by soil heaving. Where drainage is provided this soil is suited to corn and soybeans. Open ditches and diversion terraces are used to remove excess surface water and to reduce the erosion hazard in cultivated fields. Capability unit IIIw–70; woodland group 4w1.

Reaville silt loam, 6 to 12 percent slopes, eroded (ReC2).—The original surface layer of this soil has been thinned several inches by erosion. Shallow gullies are common. Included in mapping are a few small areas where slopes are 2 to 6 percent. Also included are a few areas where the soil is mottled but does not have pinkish-gray mottles above the very shaly substratum.

Runoff is rapid, and the erosion hazard is moderately severe.

This soil is suited to the kinds of crops that are grown on the less sloping Reaville soils. It is only moderately deep, and it is likely to be droughty in summer but wet in winter and in spring. In cultivated areas graded stripcropping, supplemented by diversion terraces and grassed waterways, is used to control runoff and erosion. Capability unit IIIe–70; woodland group 4w1.

Reaville Series, Wet Variant

Soils of the Reaville series, wet variant, are moderately deep, nearly level to gently sloping, and poorly drained. These soils are on upland flats and concave, gently sloping areas in the Piedmont Plateau. They formed in material weathered from red shale.

In a representative profile, in a cultivated field, the plow layer is dark reddish-brown silt loam 8 inches thick. The upper part of the subsoil is pale-brown, mottled silty clay loam 4 inches thick; and the lower part is gray heavy silty clay loam about 8 inches thick. Bedrock is at a depth of 20 inches.

The surface layer is moderately permeable, and the deeper layers are slowly permeable. Seepage is common. Small areas of these soils are used for hay and pasture, but most areas are idle.

Seepage from higher slopes and a perched water table cause these soils to dry slowly in spring. Wetness restricts the species of crops that can be grown to those that tolerate wetness. If drainage is provided, these soils are suited to pasture or to hay crops that tolerate wetness.

Representative profile of Reaville silt loam, wet variant, 0 to 2 percent slopes, in a pasture along the road to Reaville, 0.5 mile southeast of State Highway 31:

Ap—0 to 8 inches, dark reddish-brown (5YR 3/3) silt loam; moderate, medium and fine, granular structure; friable; many medium and fine roots; 10 percent shale fragments; medium acid; abrupt, smooth boundary.

B21t—8 to 12 inches, pale-brown (10YR 6/3) light silty clay loam; common, fine, distinct, gray (5Y 6/1) and strong-brown (7.5YR 5/6) mottles; moderate, medium, prismatic structure parting to weak, medium, subangular blocky; slightly sticky; few medium roots; slightly shiny low-chroma clay films on faces of peds; 10 percent coarse fragments; medium acid; gradual, wavy boundary.

B22tg—12 to 20 inches, gray (5Y 6/1) heavy silty clay loam; many, coarse, distinct, strong-brown (7.5YR 5/6) and reddish-yellow (5YR 6/6) mottles; moderate, medium, prismatic structure parting to moderate, medium, subanglar blocky; sticky; thick, continuous, ripply, shiny clay films on faces of peds; 30 percent shale fragments; strongly acid; abrupt, smooth boundary.

R—20 inches, dark-red (2.5YR 3/6) fractured shale bedrock.

The solum of this variant ranges from 20 to 28 inches in thickness. Depth to bedrock ranges from 20 to 40 inches. In places a C horizon as much as 12 inches in thickness is between the B22t horizon and the bedrock. Coarse fragments normally increase in number with depth. They make up 10 to 20 percent of the A horizon, 10 to 35 percent of the B horizon, and 30 to 70 percent of the C horizon.

The A horizon has a hue of 2.5YR and 5YR, a value of 3 or 4, and a chroma of 3 or 4. The B horizon ranges from 5YR to 7.5YR in hue; the value is 4 to 6; and the chroma is 3 or less. The texture is silt loam or silty clay loam, either of which is shaly in places.

Reaville wet variant soils adjoin and grade toward the other Reaville soils and Abbottstown, Bucks, and Penn soils. They are grayer throughout the profile than the ordinary Reaville soils and the well-drained Penn soils. They are grayer and shallower to bedrock than the somewhat poorly drained, deep Abbottstown soils and the well-drained Bucks soils.

Reaville silt loam, wet variant, 0 to 2 percent slopes (RfA).—This soil has the profile described as representative for soils of the Reaville series, wet variant. Included in mapping are a few areas where the soil is less than 20 inches deep over bedrock. Also included are a few areas where low chromas, though present, are not dominant in the layer immediately beneath the plow layer but are dominant in the deeper layers. Other inclusions are areas where recent deposition from upland erosion has buried the gray soil under a reddish silt.

Wetness is the major limitation. Runoff is slow, and water normally accumulates in low pockets in winter and early spring. This soil is suited to hay or pasture of shallow-rooted grasses and legumes that tolerate wetness. Some areas are used for the commonly grown crops. Open drains are used to remove surface water. Diversion terraces on slopes above this soil help to reduce wetness caused by runoff, seeps, or springs. Capability unit IVw–80; woodland group 4w1.

Reaville silt loam, wet variant, 2 to 6 percent slopes (RfB).—This soil is similar to the one described as representative of the Reaville series, wet variant. Included in mapping are some areas of soils that are shallower or deeper to bedrock than that soil and a few areas where low chromas are not dominant in the soil material immediately below the plow layer.

The hazard of erosion is moderate, but wetness is the major limitation. This soil is slow to dry in spring, and it is better suited to wet-tolerant grasses for hay or pasture than to other uses. It is poorly suited to alfalfa or winter small grain. Diversion terraces and grassed waterways are used to control runoff and erosion. Capability unit IVw–80; woodland group 4w1.

Riverhead Series

The Riverhead series consists of deep, nearly level to moderately steep, well-drained gravelly sandy loam soils on stream terraces. They formed in thick sandy and gravelly alluvium of glaciofluvial origin. These soils occur principally on higher terraces, 20 to 40 feet above the Delaware River. The alluvium from which these soils formed was deposited when the river was at a higher level than it is today.

In a representative profile, in a cultivated field, the soil has a dark-brown gravelly sandy loam plow layer 9 inches thick. The subsoil is dark-brown or yellowish-brown, friable gravelly sandy loam or fine sandy loam 25 inches thick. The substratum is brown, loose, stratified gravelly loamy sand.

Permeability is moderately rapid in the surface layer and subsoil and rapid in the substratum. Available water capacity is moderate. Natural fertility is moderately low. Natural reaction is strongly acid.

Most areas of these soils are now idle and are reverting to trees. A small acreage is used for pasture. Erosion control is needed.

Representative profile of Riverhead gravelly sandy loam, 2 to 6 percent slopes, in a gravel pit 0.25 mile north of Stockton:

Ap—0 to 9 inches, dark-brown (10YR 4/3) gravelly sandy loam; weak, fine, crumb structure; very friable; many fine and medium roots; 18 percent gravel; strongly acid; abrupt, smooth boundary.

B21—9 to 23 inches, dark-brown (7.5YR 4/4) gravelly light sandy loam; very weak, fine, subangular blocky structure; very friable; many medium and coarse roots; 20 percent gravel; strongly acid; gradual, wavy boundary.

B22—23 to 34 inches, yellowish-brown (10YR 5/4) gravelly fine sandy loam, many light-colored sand grains; very weak, fine, subangular blocky structure; friable; 20 percent gravel; strongly acid; diffuse, wavy boundary.

IIC—34 to 68 inches, brown (10YR 4/3) stratified gravelly loamy sand; single grained, loose; 30 percent gravel; very strongly acid.

The solum ranges from 25 to 36 inches in thickness. Depth to bedrock exceeds 10 feet. Rounded gravel ranges from 15 to 25 percent in the A horizon, 20 to 30 percent in the B horizon, and from 20 to 60 percent in the C horizon. The gravel consists of quartz, flint, chert, arkosic sandstone, and, rarely, of strongly weathered gneiss. The A horizon has a hue of 10YR, a value of 3 or 4, and a chroma of 2 to 4. In the B horizon the hue generally is 7.5YR or 10YR, the value is 4 or 5, and the chroma is 4. Texture is gravelly fine sandy loam or sandy loam. In the C horizan hue generally is 7.5YR, but it ranges to 10YR. Texture of the fine earth in this horizon is loamy sand and sand.

In this county Riverhead soils have a slightly higher content of gravel in the solum than is normal for the series, but this does not alter their usefulness or behavior.

Riverhead soils adjoin Pope soils and grade toward them. They are much more gravelly than Pope soils.

Riverhead gravelly sandy loam, 2 to 6 percent slopes (RgB).—This soil has the profile described as representative for the series. Included in mapping are small areas where slopes are 0 to 2 percent and small, scattered areas of very gravelly and cobbly soils along the Delaware River. In some areas soils are redder than the one described in the representative profile because they are derived from local red shale material. Also included are a few very small areas of very gravelly Annandale, Edneyville, and Parker soils that formed on recent alluvial fans bordering the gneissic highlands.

Almost all of this soil is idle, but small acreages are in pasture. This soil is droughty and low in fertility. It is suited to small grain, soybeans, and corn but is better suited to drought-resistant grasses and legumes for pasture. Suitable grasses are birdsfoot trefoil, timothy, and bromegrass. This soil is erodible if farmed. Capability unit IIe–57; woodland group 3o1.

Riverhead gravelly sandy loam, 6 to 18 percent slopes (RgC).—This soil has a profile similar to the one described as representative for the series, except that the gravelly substratum is closer to the surface. Included in mapping are small areas of redder soil that was derived from redder local material.

This soil is poorly suited to cultivated crops. It is better suited to drought-resistant species of grasses and legumes for pasture. Birdsfoot trefoil, timothy, and bromegrass are suitable grasses. If this soil is farmed, the hazard of erosion is a major limitation. Various combinations of cropping systems and conservation practices are used to control erosion. Capability unit IIIe–58; woodland group 3o1.

Rock Land, Edneyville Material

Rock land, Edneyville material (Rk) occurs in steep to very steep areas surrounded by Edneyville soils. Slopes range from 15 to 40 percent. Rock outcrops and boulders of quartzite larger than 24 inches in diameter cover 50 to 90 percent of the surface of this land type. Rock outcrops are about 10 feet apart.

Rock generally is at a shallower depth in areas between the rock outcrops; but some areas include full-depth soils similar to the Edneyville soils, except that they contain a large number of quartzite fragments and stones. This land type is bordered by higher Edneyville soils and lower Washington soils.

Surface runoff and internal drainage are moderately rapid. Available water capacity and fertility are low.

Boulders and steep slopes limit the use of this soil largely to growth of trees. Capability unit VIIs–67; woodland group 2x1.

Rough Broken Land, Shale

Rough broken land, shale (RlF) is along the Delaware River escarpment and the gorges of short tributaries that feed into the river. About 20 percent of this land is rock outcrop. The slopes are very steep, mostly more than 25 percent. Narrow gorges that are along the southern edge of the Hunterdon Plateau and that cut in the Musconetcong Mountain are included in mapping.

All these areas have many rock outcrops (fig. 12). The relief is very steep and extremely stony. The kinds of rocks are varied. They include red shale, red quartzite conglomerate, calcareous conglomerate, buff and gray sandstone, argillite, red shale, and granite gneiss.

Figure 12.—**Typical landscape of Rough broken land, shale, showing woods and rock outcrops along Route 29 south of Frenchtown.**

Nearly all of this land is now wooded. Timber production is limited by droughtiness and the low density of trees. Very steep slopes limit the use of equipment in the harvesting of trees. Hemlock is common in sheltered coves, especially those with a northern exposure. Capability unit VIIs–67; woodland group 5d1.

Rowland Series

The Rowland series consists of deep, nearly level, moderately well drained and somewhat poorly drained soils. They are on flood plains that are subject to stream overflow several times a year. These soils formed in sediment washed from mostly acid red shales and sandstone on uplands.

In a representative profile the plow layer is reddish-brown silt loam about 8 inches thick. The subsoil is friable silt loam about 17 inches thick. The upper part of the subsoil is yellowish red, and the lower part is reddish brown. The substratum is stratified silt loam or gravel and sand.

Rowland soils have moderately slow or moderate permeability. They have high available water capacity. Natural fertility is moderately high. Natural reaction is medium acid to strongly acid, but limed fields are less acid.

Most of the acreage has been cleared and is used for pasture. Some of it is used for growing corn. Many areas are idle and are reverting to trees.

Because of the hazard of stream overflow, the safest use of these soils is for pasture or trees.

Representative profile of Rowland silt loam, is a pasture bordering a small tributary of the Raritan River, 1.1 miles east of Ringoes along the Wirtsville Road, 30 feet south of the road:

Ap—0 to 8 inches, reddish-brown (5YR 4/3) silt loam; weak, medium, granular structure; friable; many roots; strongly acid; clear, smooth boundary.

B1—8 to 17 inches, yellowish-red (5YR 4/6) silt loam; weak, fine, subangular blocky structure; friable; many roots; strongly acid; abrupt, smooth boundary.

B2—17 to 25 inches, reddish-brown (5YR 4/4) silt loam; few, fine, yellowish-red (5YR 4/8) and pinkish-gray (5YR 6/2) mottles; weak, medium, subangular blocky structure; friable; few roots; slightly acid; gradual, smooth boundary.

C1—25 to 60 inches, strong-brown (7.5YR 5/6) silt loam; many, fine, faint, pinkish-gray (5YR 6/2) and dark-red (2.5YR 3/6) mottles; massive; slightly sticky; strongly acid; abrupt, smooth boundary.

IIC2—60 inches, stratified gravel and sand.

The solum ranges from 24 to 40 inches in thickness. Depth to bedrock ranges from 4 to 6 feet or more. Coarse fragments in the solum are mostly fine, rounded shale that makes up as much as 5 percent of any horizon but generally less. The IIC horizon is as much as 90 percent gravel and is locally composed of a high proportion of gneiss, quartzite, chert, and sandstone mixed with shale.

The A horizon has a hue ranging from 2.5YR to 7.5YR, a value of 3 to 5, and a chroma of 2 or 3. In the B horizon hue ranges from 2.5YR to 7.5YR, value is 3 to 5, and chroma is 3 to 6. The B horizon is silt loam, loam, clay loam, or sandy clay loam. Mottling is faint to prominent, and it varies in depth from 10 to 24 inches. Low chromas are within 24 inches of the surface. The content of organic matter becomes more unevenly distributed with depth. In places the C horizon is thin or is even absent, and in its place there is shale bedrock.

Rowland soils adjoin Bowmansville, Birdsboro, Penn, and Klinesville soils. They are at a slightly higher elevation than the poorly drained Bowmansville soils which generally have a finer texture in the B horizon and are grayer. Mottling in Rowland soils distinguishes them from the well-drained unmottled Birdsboro soils, which occupy higher positions on the landscape above the normal flood levels.

Rowland silt loam (Ro).—This is the only Rowland soil mapped in the county.

Most slopes are 0 to 2 percent, but in small areas slopes of slightly more than 2 percent were included in mapping. Also included are small areas of unmottled, well-drained soils at slightly higher elevations. These generally are in narrow bands along the edges of streams. In places, the texture at a depth of 2½ to 4 feet is silty clay loam rather than silt loam.

This soil is flooded very frequently late in winter, early in spring, and occasionally in summer months when rainfall is abnormally heavy. Erosion caused by runoff of rainwater generally is not a concern, but gouging and deposition result because of raging waters. Leaves, organic matter, and branches are removed and redeposited by flood waters. The deposits are dominantly silt; but adjacent to the streams and upstream from dams, they are mainly sand. Capability unit Vw–78; woodland group 2w2.

Steep Stony Land, Parker Material

Steep stony land, Parker material (SpF) has, on the surface, stones of gneiss larger than 10 inches in diameter and 3 to 5 feet apart. The soil between the stones is similar to Parker soils. Slopes are 18 to 40 percent. Included in mapping are areas where stones are as much as 30 feet apart. Also included are areas of a soil similar to Edneyville soils, but indistinguishable from Parker soils in mapping because of the many stones. In other included areas most of the stones have been removed from the surface, but below the surface layer stones make up more than 15 percent of the profile. Most of the surface is cobbly and gravelly.

Stones and steep slopes limit the use of this soil mainly to trees, wildlife habitat, recreation, and homesites. Capability unit VIIs–67; woodland group 3f1.

Turbotville Series

Turbotville soils are deep, gently sloping, and somewhat poorly drained. These soils formed in deposits of old glacial drift or in colluvium derived from old glacial drift. They contain gneiss and limestone fragments.

In a representative profile, in a cultivated area, the plow layer is dark grayish-brown loam about 10 inches thick. The upper part of the subsoil is brownish-yellow heavy loam. The middle part is prominently mottled, brownish-yellow silty clay loam. These two parts combined are 18 inches thick. The lower part of the subsoil is a fragipan of firm, dark-brown silty clay loam. It is 14 inches thick. The substratum is mottled gravelly loam about 18 inches thick. Limestone bedrock is at a depth of 60 inches.

Permeability of these soils is moderately slow. The surface layer and subsoil are medium acid to slightly acid. The substratum is nearly neutral to slightly acid. The soils have a high available water capacity, and they are moderately fertile in their natural state.

Turbotville soils contain excess water in winter and in spring. If drained, they are suited to general farm crops such as corn, soybeans, small grain, hay, and pasture. Control of erosion is needed. Grasses that tolerate wetness are the most suitable.

Representative profile of Turbotville loam, 2 to 6 percent slopes, in a cultivated area, about 200 feet north of Van Syckel crossroads:

Ap—0 to 10 inches, dark grayish-brown (2.5Y 4/2) loam; weak, fine, granular structure; very friable; many fine and medium roots; medium acid; clear, smooth boundary.

B1—10 to 18 inches, brownish-yellow (10YR 6/6) heavy loam; weak, medium, subangular blocky structure; friable; many fine and medium roots; medium acid; gradual, smooth boundary.

B2t—18 to 28 inches, brownish-yellow (10YR 6/6) silty clay loam; many, medium, prominent, light brownish-gray (10YR 6/2) and yellowish-brown (10YR 5/8) mottles; moderate, medium, subangular blocky structure; friable; shiny clay films in pores and on the faces of some peds; 5 percent coarse fragments of gneiss; medium acid; gradual, smooth boundary.

Bx—28 to 42 inches, dark-brown (7.5YR 4/4) silty clay loam; many, medium, prominent, light brownish-gray (10YR 6/2) mottles; weak, medium, prismatic structure; firm, slightly brittle; 10 percent coarse fragments of gneiss; slightly acid; gradual, smooth boundary.

C—42 to 60 inches, dark-brown (7.5YR 4/4) gravelly loam; many, medium, prominent, light brownish-gray (10YR 6/2) mottles; massive; friable; 15 percent coarse fragments of gneiss and limestone; slightly acid.

R—60 inches, impure, thinly bedded, limestone bedrock.

The solum ranges from 40 to 60 inches in thickness. Depth to the fragipan is 20 to 30 inches. Depth to bedrock is 5 to 8 feet or more. Gravel makes up 1 to 15 percent of the solum and as much as 35 percent of the C horizon. It consists of gneiss, limestone, and chert.

In the A horizon the hue is 2.5Y or 10YR, the value is 3 or 4, and the chroma generally is 2 but ranges to 3. The B horizon has a hue of 10YR or 7.5YR, a value of 4 to 6, and a chroma of 4 to 8. Texture of the B horizon is loam, heavy loam, heavy silt loam, silty clay loam, or clay loam. The C horizon has a hue of 10YR or 7.5YR. The texture is loam, gravelly loam, sandy loam, or gravelly sandy loam.

In places a horizon that contains a large amount of fine sand derived from the weathering limestone is above the R horizon. Turbotville soils adjoin Duffield and Washington soils. Mottling in the subsoil distinguishes these soils from the well-drained Duffield and Washington soils.

Turbotville loam, 2 to 6 percent slopes (TuB).—This is the only Turbotville soil mapped in the county. It has the profile described as representative for the series. Included in mapping are areas of reddish, somewhat poorly drained soils derived from red calcareous conglomerate. In addition, near Annandale, small areas of similar soils that are high in content of quartzite are included. Areas of moderately well drained soils are also included.

Runoff is medium, and the erosion hazard is moderate. Seepage is a common concern. The soil dries slowly in spring.

If the soil is properly drained, it is well suited to corn, small grain, soybeans, and garden vegetables. Graded stripcropping supplemented by diversion terraces and waterways helps to control erosion. Capability unit IIe–71; woodland group 2w1.

Washington Series

The Washington series consists of deep, gently sloping to strongly sloping, well-drained soils. They formed in glacial drift that contained large amounts of limestone and gneiss and some chert gravel.

In a representative profile the plow layer is dark yellowish-brown loam about 9 inches thick. The upper part of the subsoil is strong-brown heavy loam about 8 inches thick. Below this, the subsoil is strong-brown clay loam that is about 35 inches in thickness. The substratum is brownish-yellow loam 20 inches thick. Massive, dark-gray, shaly limestone bedrock is at a depth of 72 inches.

Permeability is moderate throughout the profile. Available water capacity and natural fertility are high. Natural reaction is slightly acid near the surface to neutral at a depth of about 3 or 4 feet.

Most Washington soils have been cleared for farming. They are well suited to corn and general farm crops. Alfalfa grows well. Erosion needs to be controlled.

Representatives profile of Washington loam, 2 to 6 percent slopes, in a pasture, 3 miles northeast of West Portal:

Ap—0 to 9 inches, dark yellowish-brown (10YR 3/4) loam; moderate, medium, granular structure; 10 percent subangular gravel of granitic gneiss, sandstone, chert, and leached limestone; neutral; clear, smooth boundary.

B21t—9 to 17 inches, strong-brown (7.5YR 5/6) heavy loam; moderate, fine and medium, subangular blocky structure; friable; many fine roots; few thin clay films on faces of peds; 5 percent granitic gneiss fragments ⅛ to ¼ inch in diameter; many worm channels filled with dark soil material; neutral; diffuse, wavy boundary.

B22t—17 to 29 inches, strong-brown (7.5YR 5/6) clay loam; strong, medium and coarse, subangular blocky structure; friable; few very fine roots; many thick clay films on faces of peds and in the many worm channels; 5 percent weathered gneiss fragments ¼ to 1¼ inches in diameter; neutral; diffuse, wavy boundary.

B23t—29 to 42 inches, strong-brown (7.5YR 5/6) clay loam; moderate, medium, subangular and angular blocky structure; friable; patchy manganese stains; thin patchy clay films on faces of peds; coarse sand and fine gravel impart gritty feel; 10 percent weathered gneiss, quartz, and chert gravel and few soft, weathered, limestone pebbles; neutral; gradual, wavy boundary.

B3t—42 to 52 inches, strong-brown (7.5YR 5/6) light clay loam; moderate, medium, subangular and angular blocky structure; friable; thin, very patchy clay films on faces of peds; 10 percent gneiss, quartz, chert, and limestone gravel; coarse sand and fine gravel, more than in the horizon above, impart a more gritty feel; neutral; diffuse, irregular boundary.

C—52 to 72 inches, brownish-yellow (10YR 6/8) blotched with strong-brown (7.5YR 5/6) heavy loam grading with depth to gravelly loam; massive; friable; coarse fragments increase from 10 to 35 percent with depth, and more limestone or limey shale and less gneiss occur as depth increases; neutral; extremely irregular boundary.

R—72 inches, massive and shaly dark-gravy limestone; many large solution cavities.

The solum ranges from 40 to 60 inches in thickness. Depth to bedrock is 5 to 8 feet or more. Coarse fragments of gneiss, chert, and limestone make up 5 to 35 percent of the overall solum and 10 to 35 percent of the C horizon. In the B horizon color ranges from yellowish brown (10YR 5/4) to brownish yellow (10YR 6/8) and from strong brown (7.5YR 5/6) to reddish yellow (7.5YR 6/8). The texture ranges from silt loam to silty clay loam, clay loam, or heavy loam. In the C horizon color ranges from brownish yellow (10YR 6/8) to yellowish red (5YR 5/8). Faint, coarse variegation is common. Texture in the C horizon is loam, silt loam, or clay loam.

Washington soils adjoin Berks, Bedington, Duffield, and Annandale soils and grade toward them. They are much deeper to bedrock than Berks soils, and they lack the shale that is characteristic of Bedington soils. Washington soils are firmer and more gravelly than Duffield soils, and they are less acid and lack the fragipan common to Annandale soils.

Washington loam, 2 to 6 percent slopes (WaB).—This soil has the profile described as representative for the series. Included in mapping are small areas of soils that have slopes of less than 2 percent and some that have a gravelly loam surface layer. Also included are areas where the topsoil contains more gneiss and less limestone fragments than that of this soil and a few areas where the soil is moderately well drained. Runoff is medium, and the erosion hazard is moderate.

This soil is well suited to corn, soybeans, vegetables (fig. 13), hay, and pasture. Capability unit IIe–54; woodland group 1o1.

Washington loam, 6 to 12 percent slopes, eroded (WaC2).—This soil is similar to the one described as representative for the series, except that erosion has thinned it, and material from the lighter colored, more clayey subsoil is mixed into the plow layer. Shallow gullies are

Figure 13.—Crop of spinach on Washington loam. Wooded area in background consists of Edneyville and Parker soils.

common. Small areas where slopes are greater than 12 percent are included in mapping.

The plow layer is low in content of organic matter, and as a result the soil is difficult to till. Runoff is rapid, and the erosion hazard is moderately severe.

This soil is well suited to corn, small grain, soybeans, hay, or pasture. Cover crops, contour stripcropping, diversion terraces, and cropping systems that include sod are used to reduce the hazard of further erosion on this soil. Capability unit IIIe–54; woodland group 1o1.

Watchung Series

The Watchung series consists of deep, nearly level, poorly drained soils that formed in material weathered from diabase rock. These soils have slightly concave slopes and are in low positions in the landscape.

In a representative profile the surface layer and subsurface layer are gray silt loam, and combined they are about 6 inches thick. The upper part of the subsoil is firm, gray, mottled silty clay loam about 5 inches thick. The lower part is firm, light-gray, mottled silty clay loam 25 inches thick. The substratum is mottled, light-gray and pale-olive silt loam that contains many very weathered diabase fragments.

Permeability of this soil is slow. Available water capacity is high.

Natural fertility is moderate, and natural reaction is strongly acid.

Most areas of Watchung soils are wooded. Small areas have been cleared and are used for farming. Wetness results because of the low position in the landscape and the slow movement of water through these soils. Unless drainage is provided these soils are better suited to pasture or trees than to other uses. Hay, small grain, and corn are suitable if the soils are drained intensively.

Representative profile of Watchung silt loam, in a wooded area, 0.25 mile southwest of intersection of State Highway 31 and Route 579;

O1—1 inch to 0, thin layer of organic litter.

A1—0 to 2 inches, gray (10YR 5/1) silt loam; weak, medium, subangular blocky structure; friable; many fine, medium and coarse roots; very strongly acid; clear, wavy boundary.

A2—2 to 6 inches, gray (10YR 6/1) silt loam; nearly 50 percent is mottled yellowish brown (10YR 5/6); moderate, very thick, platy structure; friable; many coarse, medium, and fine roots; very strongly acid; clear, wavy boundary.

B21tg—6 to 11 inches, gray (10YR 6/1) silty clay loam; many coarse, distinct, yellowish-brown (10YR 5/6) mottles; strong, medium, subangular blocky structure; firm when moist, hard when dry; few medium and coarse roots; thick, slightly shiny clay films on faces of peds; very strongly acid; gradual, wavy boundary.

B22tg—11 to 36 inches, light-gray (5Y 7/1) heavy silty clay loam; many light brownish-gray (10YR 6/2) and strong-brown (7.5YR 5/6) mottles; strong, medium and coarse, prismatic structure parting to strong, coarse, subangular blocky, firm; few medium and coarse roots; thick, continuous, shiny, ripply clay films on faces of peds; few black manganese stains; 3 percent very weathered diabase fragments; strongly acid; gradual, wavy boundary.

C1g—36 to 41 inches, light-gray (5Y 7/1) silt loam; common strong-brown (7.5YR 5/6) and reddish-yellow (7.5YR 6/6) mottles; massive; slightly firm; strongly acid, abrupt, wavy boundary.

C2—41 to 60 inches, pale-olive (5Y 6/4) silt loam; common, medium and coarse, light-gray (5Y 7/1) mottles; massive; friable; many, small, light-gray clay balls; many very weathered diabase fragments; medium acid.

The solum ranges from 30 to 40 inches in thickness. Depth to bedrock ranges from 5 to 7 feet or more. The Ap horizon in cultivated areas is dark grayish brown (10YR 4/2). In the upper part of the B horizon, the matrix has a hue of 10YR, a value of 5 to 7, and a chroma of 1 or 2. In some profiles the chroma is 4 to 6 in the lower part. The B horizon ranges in texture from silty clay loam to silty clay, and it generally contains gravel.

Angular, diabase, coarse fragments in these soils range from 1 inch to 6 inches in diameter. The solum is 2 to 5 percent coarse fragments, and the C horizon is as much as 20 percent coarse fragments. Generally the C horizon, below a depth of 4 feet, consists of a more granular saprolite derived from medium-textured diabase.

Watchung soils adjoin Neshaminy and Mount Lucas soils and grade toward them. Mottling in the B horizon of Watchung soils distinguishes them from Neshaminy soils. Mottles just below the surface in Watchung soils and general grayness throughout the profile distinguish them from Mount Lucas soils. In this county Watchung soils generally are less than 35 percent clay in the B horizon. This is less than the defined range for the series, but it does not alter their usefulness or behavior.

Watchung silt loam (Wc).—This is the only Watchung soil mapped in the county. It has the profile described as representative for the series. Slopes are dominantly less than 2 percent. Included in mapping, on the Watchung Mountains, are areas where the material in the surface layer is heavier than that of this soil, and the substratum is very firm till over basalt.

Wetness is a severe limitation to crop production. Excess water is perched over a silty clay loam subsoil. Open ditches are used to drain this soil. Tile drains generally do not remove the water fast enough to prevent crop losses, but in places deep tile drains will reach the more permeable saprolite. In drained areas pasture and hay are the most suitable crops, but corn and spring-seeded small grain grow fairly well. Capability unit Vw–80; woodland group 1w1.

Use and Management of the Soils

The soils of Hunterdon County are used mainly for cultivated crops, pasture, and trees. This section explains how the soils can be managed for those purposes, and it rates the soils according to their productivity for the principal crops. It also discusses soils in relation to wildlife management, to woodland management, to engineering, and to town and country planning.

This section is a general guide for managing the soils and does not suggest specific management for individual soils. Detailed information about managing the soils can be obtained from the local staff of the Soil Conservation Service, from the Agricultural Extension Service, or from the New Jersey Agricultural Experiment Station at Rutgers University.

General Management for Crops and Pasture

The principal concerns in managing the soils for the production of crops and pasture are maintaining fertility, controlling erosion, and providing drainage. Practices for all of the soils that are suitable for crops and pasture are discussed in the following paragraphs. The management of

specific groups of soils is discussed under the heading "Capability Grouping."

On most soils in the county, additions of lime and fertilizer are needed. The amounts depend on the natural content of lime and plant nutrients, on past cropping and level of management, on the need of the crop, and on the level of production desired. Suggestions for additions of lime and fertilizer are only general in this survey. Fields should be limed and fertilized according to the needs indicated by soil tests and in accordance with current recommendations of the Agricultural Extension Service and New Jersey Agricultural Experiment Station at Rutgers University.

The soils of Hunterdon County are naturally medium in organic-matter content. This content can be maintained or increased through proper management of residue that includes plowing in cover crops, growing a sod crop in the cropping sequence and returning both animal manure and crop residue to the soils. Commercial fertilizer is beneficial to all crops. On soils subject to rapid leaching, it is more effective to add fertilizer in more than one application during the growing season.

Tillage is needed to prepare a seedbed and to control weeds but it should be kept to a minimum because it generally tends to break down the structure of the soil. Also helpful in preventing a breakdown of structure are the adding of organic matter and the growing of sod crops, cover crops, and green-manure crops.

All of the sloping soils in the county that are cultivated are susceptible to erosion and to loss of organic matter and plant nutrients from the surface layer. Because most erosion occurs while the cultivated crop is growing, or soon after the crop has been harvested, a cropping sequence should be selected that keeps the loss of soil and water to a minimum. Such a sequence is more effective if one or more practices of erosion control are used. Helpful practices are contour cultivating, terracing, stripcropping, providing diversions and grassed waterways, using minimum tillage, properly using crop residues, planting cover crops, and applying fertilizer and lime when needed.

In Hunterdon County many of the soils are wet because of runoff from adjacent areas, a slowly permeable subsoil, a fluctuating water table, or a combination of these. In places diversions can be used to deflect runoff from adjacent areas. Random or parallel shallow field ditches are needed in other places to guide the water to main, natural waterways or to deep, open ditches. Examples of wet soils are the Abbottstown, Chalfont, Croton, and Lansdowne soils, which are underlain by a fragipan or are slowly permeable in the subsoil. Soils that have a fragipan are difficult to drain, but they can be drained by open ditches and by tile drains. Open ditches are more effective if they intercept the water as it moves horizontally on top of the pan. Where tile drainage is practical, tiles generally provide better drainage than open ditches. For drainage by either system, suitable outlets are required.

Capability grouping

Capability grouping shows, in a general way, the suitability of soils for most kinds of field crops. The groups are made according to the limitations of the soils when used for field crops, the risk of damage when they are used, and the way they respond to treatment. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils; does not take into consideration possible but unlikely major reclamation projects; and does not apply to rice, cranberries, horticultural crops, or other crops requiring special management.

Those familiar with the capability classification can infer from it much about the behavior of soils when used for other purposes, but this classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for forest trees or engineering.

In the capability system, all kinds of soils are grouped at three levels; the capability class, the subclass, and the unit. These are discussed in the following paragraphs.

Capability Classes, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use, defined as follows:

Class I soils have few limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants, require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants, require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use largely to pasture, woodland, or wildlife habitat.

Class VI soils have severe limitations that make them generally unsuited to cultivation and limit their use largely to pasture, woodland, or wildlife habitat.

Class VII soils have very severe limitations that make them unsuited to cultivation and that restrict their use largely to pasture, woodland, or wildlife habitat.

Class VIII soils and landforms have limitations that preclude their use for commercial plants and restrict their use to recreation, wildlife, water supply, or to esthetic purposes. (No class VIII soils in Hunterdon County.)

Capability Subclasses are soil groups within one class; they are designated by adding a small letter, *e*, *w*, *s*, or *c*, to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is too cold or too dry. (No subclass *c* soils in Hunterdon County.)

In class I there are no subclasses, because the soils of this class have few limitations. Class V can contain, at the most, only the subclasses indicated by *w*, *s*, and *c*, because the soils in class V are subject to little or no erosion, though

they have other limitations that restrict their use largely to pasture or range, woodland, wildlife, or recreation.

CAPABILITY UNITS are soil groups within the subclasses. The soils in one capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity and other responses to management. Thus, the capability unit is a convenient grouping for making many statements about management of soils. Capability units are generally designated by adding an Arabic numeral to the subclass symbol, for example, IIe–4 or IIIe–6. Thus, in one symbol, the Roman numeral designates the capability class, or degree of limitation; the small letter indicates the subclass, or kind of limitation, as defined in the foregoing paragraph; and the Arabic numeral specifically identifies the capability unit within each subclass.

In the following pages the capability units in Hunterdon County are described, and suggestions for the use and management of the soils are given. The units are part of a statewide classification, not all units of which are represented in this county; consequently, the numbers that identify the units are not consecutive.

CAPABILITY UNIT I–55

This unit consists of deep, well-drained, level or nearly level soils of the Birdsboro and Quakertown series. These soils are on uplands and terraces. They formed in alluvial material and in material weathered from fine-grained sandstone, siltstone, and shale.

Generally, these soils are medium in organic-matter content, moderate in natural fertility, and medium acid to strongly acid in reaction. Available water capacity is high, and permeability is moderately slow to moderate.

Under high-level management, the soils in this unit are excellent for corn, small grain, and soybeans; and they are suited or orchard, nursery, vegetable, and other specialized crops (fig. 14). Furthermore, they are well suited to alfalfa, ladino clover, orchardgrass, smooth bromegrass, and almost all other grasses and legumes commonly grown in the county.

These soils are not subject to erosion. They can be cultivated continuously if high-level management is practiced. Irrigation can be used to advantage, especially for high-value crops.

Figure 14.—**Peas on class I soils of the Birdsboro series.**

CAPABILITY UNIT I–57

Pope fine sandy loam is the only soil in this unit. It is a deep, well-drained, level or nearly level soil on high flood plains along the Delaware River. This soil formed in alluvium washed from areas of shale, sandstone, limestone, granite gneiss, and glacial till.

This soil is medium in organic-matter content, low in natural fertility, and medium acid to slightly acid in reaction. Available water capacity is moderate, and permeability is moderately rapid.

Under high-level management, this soil is well suited to corn, small grain, and soybeans. It is suited to nurseries and to fruit and vegetables and other specialized crops. Furthermore, it is well suited to all the locally grown grasses and legumes, including alfalfa, red clover, orchardgrass, smooth bromegrass, and ladino clover.

The soil in this unit is not subject to erosion and, therefore, can be cultivated continuously if high-level management is practiced. It can be tilled throughout a wide range of moisture content without clodding or crusting. It is well suited to irrigation, especially for high-value crops.

Some areas are subject to flooding, but floods generally are of short duration and occur in winter or early in spring. Plowing and preparing of seedbeds are delayed in some year because of floods late in spring.

CAPABILITY UNIT IIe–51

This unit consists of deep, well-drained, gently sloping soils of the Meckesville and Norton series. These soils are on uplands. They formed in material weathered from glacial till and shale bedrock.

These soils are medium in organic-matter content, moderate in natural fertility, and medium acid to strongly acid in reaction. Available water capacity is high, and permeability is slow in the subsoil.

The soils in this unit are suited to nearly all cultivated crops and pasture plants grown in the county. The main crops are corn, soybeans, small grain, grain sorghum, sudangrass, alfalfa, orchardgrass, smooth bromegrass, ladino clover and red clover, and birdsfoot trefoil.

Erosion is a moderate hazard in cultivated fields, but it can be controlled by use of various combinations of cropping systems and conservation practices. If adequate conservation practices are used, the soils can be cultivated year after year. Irrigation can be used to advantage, especially for high-value crops.

CAPABILITY UNIT IIe–53

This capability unit consists of deep, well-drained, gently sloping soils of the Annandale, Edneyville, and Bedington series. These soils are on uplands. They formed in material weathered from brown and yellow shale, granite gneiss, and glacial till that was predominantly granite gneiss. Annandale soils have a firm, compact, and brittle fragipan at a depth of 24 to 36 inches. This restricts the movement of water and the growth of plant roots.

These soils are medium in organic-matter content, moderate in natural fertility, and medium acid to strongly acid in reaction. Available water capacity is moderate to high. Permeability is moderate, except in Annandale soils, where it is moderately slow in the fragipan.

The soils of this unit are well suited to a number of different field crops and to hay and pasture. The principal

crops are corn, soybeans, small grain, alfalfa, orchardgrass, smooth bromegrass, timothy, ladino clover, and birdsfoot trefoil. These soils are also well suited to fruits and vegetables and other specialized crops. They are not well suited to nursery crops, because the large amounts of shale, gravel, and cobblestones make digging difficult. The erosion hazard is moderate in cultivated fields. Irrigation is needed in places for high-value crops.

CAPABILITY UNIT IIe-54

This unit consists of deep, well-drained, gently sloping soils of the Athol, Duffield, and Washington series. These soils are on uplands. They formed in material weathered from red calcareous conglomerate and limestone bedrock.

These soils are medium in organic-matter content, high to moderate in natural fertility, and strongly acid to neutral in reaction. Available water capacity is moderately high to high, and permeability is moderate in the subsoil.

The soils in this unit are well suited to row crops and small grain and to the hay and pasture crops commonly grown in the county. The primary crops are corn, soybeans, small grain, alfalfa, ladino clover, red clover, timothy, and birdsfoot trefoil (fig. 15).

The soils are well suited to fruits and vegetables and other specialized crops. All but the gravelly Athol soils are well suited to nursery crops.

The hazard of erosion is the main limitation if these soils are farmed, but under high-level management they generally can be cultivated year after year. The available water supply is adequate, except during abnormally dry periods. Irrigation can be used to advantage for high-value crops.

Figure 15.—**Corn and other crops on soils of Duffield and Washington series, in capability unit IIe-54. Large sinkhole in field at center.**

CAPABILITY UNIT IIe-55

This unit consists of deep, well-drained, nearly level to gently sloping soils of the Birdsboro, Bucks, Lansdale, Neshaminy, and Quakertown series. These soils are on uplands and stream terraces. They formed in old alluvium and in material weathered from red shale, sandstone, siltstone, and diabase.

These soils are medium in organic-matter content, moderate to high in natural fertility, and strongly acid to medium acid in reaction. Available water capacity is high, and permeability is moderately slow to moderate.

The soils in this unit are well suited to the row crops, small grain, and hay and pasture plants commonly grown in the county. Corn, soybeans, small grain, alfalfa, ladino clover, timothy, and birdsfoot trefoil are some of the main crops. Fruit, nursery, vegetable, and other specialized crops are well suited. Neshaminy gravelly loam is less suitable for growing nursery stock because the gravel and cobblestone limit cultivation and digging.

If these soils are farmed, the greatest concern of management is the erosion hazard; but under high-level management they can be cultivated year after year. Except during abnormally dry periods, plants receive sufficient moisture for crop growth. If an adequate supply of water is available, irrigation can be used to advantage, especially for high-value crops.

CAPABILITY UNIT IIe-57

Riverhead gravelly sandy loam, 2 to 6 percent slopes, is the only soil in this unit. It is a deep, well-drained, gently sloping soil on stratified glacial outwash plains.

This soil is medium in organic-matter content, moderately low in natural fertility, and strongly acid in reaction. Available water capacity is moderate. Permeability is moderately rapid in the subsoil and rapid in the substratum.

Under high-level management this soil is well suited to corn, soybeans, small grain, and hay and pasture plants. Vegetables and other specialized crops are also well suited.

The hazard of erosion is a major limitation of this soil if it is farmed, but droughtiness is also a hazard. In places the gravel content is high enough to interfere with cultivation. Various combinations of cropping systems and conservation practices can be used to control surface runoff and erosion. Contour cultivation and stripcropping are used to reduce erosion on some of the long slopes. Irrigation can be used, especially for the high-value crops.

CAPABILITY UNIT IIe-58

This unit consists of deep, well-drained, gently sloping soils of the Edneyville, Hazleton, Legore, and Pattenburg series. These soils are on uplands. They formed in material weathered from granite gneiss, sandstone, diabase, and red shale conglomerate.

The soils in this unit are medium in organic-matter content, low to moderate in natural fertility, and strongly acid to medium acid in reaction. Available water capacity is moderate to moderately low, and permeability is moderate to moderately rapid in the subsoil.

The soils in this unit are suited to a number of different row crops and to hay and pasture. The principal crops are corn, soybeans, small grain, alfalfa, red clover, orchardgrass, smooth bromegrass, timothy, and ladino clover. The soils are also suited to fruit and other specialized crops. Nursery crops are not well suited, because the large amounts of shale and gravel make digging difficult.

The hazard of erosion is moderate on these soils. Surface runoff and erosion can be controlled by a few simple practices, such as establishing terraces and diversions or by using a cropping system that maintains the organic-matter content in the soil. If the soils are well managed, they generally can be cultivated year after year. Irrigation can be used to advantage for high-value crops.

CAPABILITY UNIT IIe-65

This unit consists of moderately deep and deep, well-drained, gently sloping soils of the Berks, Penn, and Bucks series. They are dominantly moderately deep. These soils are on uplands. They formed in material weathered from red, brown, and yellow shales.

The soils are medium in organic-matter content, moderate in natural fertility, and medium acid to strongly acid in reaction. Available water capacity is low to high, and permeability ranges from moderately rapid to moderately slow.

These soils are well suited to soybeans, small grain, hay, and pasture. They are only fairly well suited to corn, vegetables, alfalfa, and ladino clover.

The erosion hazard can be reduced through the use of various combinations of cropping systems and conservation practices. Irrigation generally is worthwhile for high-value crops.

CAPABILITY UNIT IIe-71

This unit consists of deep, moderately well drained and somewhat poorly drained, nearly level to gently sloping soils of the Califon, Lawrenceville, Mount Lucas, Pattenburg, Raritan, Readington, and Turbotville series. These soils are on uplands and stream terraces. They formed in material weathered from granit gneiss, diabase, quartzose conglomerate, and limestone and in old alluvium from sandstone, siltstone, and shale.

These soils are medium in organic-matter content, low to moderate in natural fertility, and very strongly acid to slightly acid in reaction. The available water capacity is moderately low to high, and permeability is moderate to slow in the subsoil. Califon, Lawrenceville, Readington, Raritan, and Turbotville soils have a fragipan in the lower part of the subsoil at a depth of about 2 feet. This limits the depth of the rooting zone and restricts the movement of air and water. Water generally moves laterally over the fragipan. Seepage is common where there is an excavation in these soils.

The soils in this unit are well suited to corn, soybeans, vegetables, spring grain, hay, and pasture. Winter small grain is affected by the perched water table and the frost heaving in winter. Alfalfa and other deep-rooted legumes grow satisfactorily. The hazard of erosion is the main limitation of these soils. If high-level management is used, the soils generally can be cultivated year after year. Drainage is effective in Mount Lucas and Pattenburg soils. It reduces wetness in depressions or on lower slopes, and it eliminates springs and seeps.

CAPABILITY UNIT IIw-71

This capability unit consists of deep, moderately well drained to somewhat poorly drained, nearly level soils of the Califon and Raritan series. These soils have frag-

ipans and are on uplands and stream terraces. They formed in material weathered from granite gneiss and in old alluvium from red shale, siltstone, and sandstone.

These soils generally are medium in organic-matter content, moderate in natural fertility, and medium acid to strongly acid in reaction. Available water capacity is high, and permeability is slow or moderately slow in the subsoil. The fragipan subsoil limits the depth of rooting and restricts the movement of air and water.

The soils in this unit are better suited to crops that tolerate some wetness than to other crops. Corn, soybeans, hay, or pasture are well suited. Areas in alsike clover, ladino clover, birdsfoot trefoil, timothy, smooth bromegrass, and orchardgrass need high-level management. Winter small grain, alfalfa, and deep-rooted legumes are subject to winterkill because of the seasonal high water table and frost heaving.

The hazard of erosion is only slight, and the soils can be cultivated year after year. Tilth generally is good, and it can be maintained by using a cropping system that includes a cover crop or by the proper use of crop residue. Wetness is the main limitation of these soils, and in spring and after heavy rains, plowing and cultivation are often delayed. Drainage ditches are effective in removing surface water, but tile drains generally are not satisfactory. In places diversion terraces are used to divert runoff from adjacent, higher areas.

CAPABILITY UNIT IIw–79

Only Alluvial land, loamy, is in this unit. It is deep, moderately well drained to somewhat poorly drained, nearly level land on flood plains. It is subject to occasional stream overflow.

Alluvial land, loamy, is medium in organic-matter content, medium to high in natural fertility, and strongly acid to neutral in reaction. Available water capacity is high, and permeability is moderate to moderately rapid throughout the profile. The water table is moderately high. Most floods occur early in spring, before the normal growing season, and are of short duration. Generally crops can be grown, however; and corn and soybeans are well suited under high-level management that includes use of a drainage system. Ladino clover, red clover, bromegrass, orchardgrass, and reed canarygrass are also well suited.

This soil is not subject to erosion, and it can be cultivated year after year. It is easy to till, but plowing or cultivation is sometimes delayed after heavy rains.

Wetness and flooding are the main limitations to use. Because the land is permeable, tile drains can be used if suitable outlets are available. Ditches are effective in removing surface water. In some areas diversion terraces prevent overwash from adjacent hillsides.

CAPABILITY UNIT IIIe–51

This unit consists of deep, well-drained, sloping, eroded soils of the Meckesville and Norton series. These soils are on uplands. They formed in material weathered from glacial till and shale bedrock.

These soils are low in organic-matter content, moderate in natural fertility, and strongly acid in reaction. Available water capacity is high, and permeability is slow in the subsoil.

The principal crops suited to these soils are corn, small grains, alfalfa, orchardgrass, smooth bromegrass, timothy, ladino clover, red clover, and birdsfoot trefoil. If cultivated or left bare, the soils have a moderately severe erosion hazard. Various combinations of cropping systems and conservation practices can be used to reduce this hazard.

CAPABILITY UNIT IIIe–53

This capability unit consists of deep, well-drained, sloping or strongly sloping, eroded soils of the Annandale, Edneyville, and Bedington series. The Annandale soils have a firm, compact, and brittle fragipan at a depth of 24 to 36 inches. This restricts the movement of air and water and limits the depth of the rooting zone. These soils are on uplands. They formed in material weathered from brown and yellow shale, granite gneiss, and glacial till that was predominately of granite gneiss.

These soils are medium to low in organic-matter content, medium in natural fertility, and medium to strongly acid in reaction. Available water capacity is moderate to high. Permeability is moderate, except in the Annandale soils where it is moderately slow in the fragipan.

These soils are suited to most of the crops grown in the county. If they are cultivated, the erosion hazard is moderately severe. Various combinations of cropping systems and conservation practices can be used to reduce the erosion hazard.

CAPABILITY UNIT IIIe–54

This unit consists of deep, well-drained, sloping, eroded soils of the Athol, Duffield, and Washington series. These soils are on uplands. They formed in material weathered from red calcareous conglomerate, limestone, and mixed gneissic till and limestone.

These soils are low in organic-matter content, high to moderate in natural fertility, and strongly acid to neutral in reaction. Available water capacity is moderately high to high, and permeability is moderate.

The soils in this unit are well suited to a wide range of crops, such as corn, soybeans, small grain, hay, and pasture. Alfalfa, orchardgrass, smooth bromegrass, timothy, ladino clover, red clover, and birdsfoot trefoil grow well. Fruits, vegetables, and other specialized crops are also well suited. All but the gravelly Athol soils are well suited to nurseries. Athol soils require extra hand labor to remove trees and shrubs.

If these soils are cultivated, there is a moderately severe erosion hazard, and frequent cultivation results in excessive erosion and damage to the soil. Various combinations of cropping systems and conservation practices can be used to help reduce the erosion hazard.

CAPABILITY UNIT IIIe–55

This unit consists of deep, well-drained, sloping and eroded soils of the Birdsboro, Bucks, Lansdale, Neshaminy, and Quakertown series. These soils are on uplands and stream terraces. They formed in old alluvium and in material weathered from red shale, sandstone, siltstone, and diabase.

These soils are medium or low in organic-matter content, moderate to high in natural fertility, and strongly acid to medium acid in reaction. Available water capacity is high, and permeability is moderate or moderately slow.

The soils in this unit are well suited to a wide range of crops such as corn, soybeans, and small grain. Alfalfa, ladino clover, timothy, and birdsfoot trefoil are some of

the main hay crops. The soils are well suited to nurseries and to fruits and vegetables and other specialized crops.

The erosion hazard is a major concern in managing these soils. Various combinations of cropping systems and conservation practices can be used to control runoff and to reduce erosion (fig. 16).

CAPABILITY UNIT IIIe–58

This unit consists of deep, well-drained, sloping to moderately steep soils of the Edneyville, Legore, Pattenburg, Riverhead, and Hazleton series. Some of these soils are eroded. These soils are on uplands. They formed in material weathered from granite gneiss, sandstone, diabase, red shale conglomerate, and sandy glacial deposits.

These soils are medium or low in organic-matter content, moderate to low in natural fertility, and strongly acid to very strongly acid in reaction. Available water capacity is moderate to low. Permeability is moderate in the subsoil, except in Hazleton and Riverhead soils, where it is moderately rapid.

The soils in this unit are suited to corn, soybeans, small grain, hay, and pasture and to fruits, vegetables, and other specialized crops. Alfalfa, red clover, orchardgrass, smooth bromegrass, timothy, and ladino clover are the better suited grasses and legumes. Nursery crops are not well suited because the large amounts of shale, gravel, and cobblestones interfere with digging operations.

If farmed, the hazard of erosion is a major limitation of these soils. Various combinations of cropping systems and conservation practices can be used to reduce the erosion hazard.

CAPABILITY UNIT IIIe–65

This unit consists of moderately deep and deep, well-drained, sloping soils of the Berks, Penn, and Bucks series. These soils are on uplands. They formed in material weathered from red, yellow, and brown shale and from siltstones and sandstones.

These soils are medium in organic-matter content, moderate in natural fertility, and medium acid to strongly acid in reaction. Available water capacity is low to high, and permeability ranges from moderately rapid to moderately slow.

These soils are well suited to small grain, hay, and pasture. They are only fairly suited to corn, vegetables, alfalfa, and ladino clover. In cultivated fields erosion is a major hazard, but the hazard can be reduced by using various combinations of cropping systems and conservation practices.

CAPABILITY UNIT IIIe–70

This unit consists of deep and moderately deep, well-drained to somewhat poorly drained, sloping soils of the Chalfont, Lehigh, Quakertown, Lawrenceville, Readington, and Reaville series. These soils are on uplands. They formed in material weathered from argillite, metamorphosed shale, sandstone, and siltstone and in shale and windblown silts. In the Chalfont, Lawrenceville, and Readington soils, the lower part of the subsoil is a firm, com-

Figure 16.—**Contour stripcropping on Neshaminy silt loam, 6 to 12 percent slopes, in capability unit IIIe–55. Strips are corn, small grain, and hay.**

pact, and brittle fragipan that limits the depth of the rooting zone and restricts the movement of air and water.

These soils generally are medium in organic-matter content, moderate in natural fertility, and medium acid to strongly acid in reaction. Available water capacity is high to moderate, and permeability is moderate to slow in the subsoil.

The soils in this unit are best suited to crops that tolerate some wetness. Corn, soybeans, and spring-sown small grain are well suited. Winter small grain is not so well suited because of a perched water table and the hazard of frost heaving.

If these soils are farmed, the erosion hazard is the major concern. Various combinations of cropping systems and conservation practices can be used to control runoff and to reduce the hazard of erosion.

Tilth generally is fair in these soils. It can be improved by using cover crops and sod crops in a cropping system. Heavy rains sometimes delay plowing and cultivation because of wetness of the soil. Random tile drains and diversions are effective in reducing wetness on lower slopes, and they help to eliminate water from springs and seeps.

CAPABILITY UNIT IIIw–70

This unit consists of deep, nearly level and gently sloping soils of the Abbottstown, Chalfont, Landsdowne, Lehigh, Quakertown, and Reaville series. Abbottstown and Chalfont soils are somewhat poorly drained; Lansdowne, Lehigh, and Reaville soils are moderately well drained to somewhat poorly drained; and Quakertown soils are well drained. These soils are on uplands. They formed in material weathered from argillite, metamorphosed shale, fine-grained sandstone, siltstone, and shale or in deep deposits of silt.

These soils are medium in organic-matter content and moderate in natural fertility. Available water capacity is moderate to high, and reaction is medium acid to strongly acid. Permeability is slow in the subsoil, except in the Reaville and Quakertown soils, where it is moderately slow.

Most of these soils are wet. Suitable crops are soybeans, corn, spring small grain, hay, pasture, and similar plants that tolerate wetness. If drainage is provided, fall small grain is also suitable. Alfalfa and other deep-rooted crops are not suited. A high level of management is required for tall fescue, reed canarygrass, ladino clover, alsike clover, and red clover.

Wetness is the main limitation of these soils. Water remains on the surface early in spring and after heavy rains. At a depth of about 20 inches is a fragipan that limits the depth of the rooting zone and restricts the movement of air and water. Reaville and Quakertown soils lack a fragipan. Drainage ditches are effective in removing surface water, but drainage by tile generally is too slow to be practicable. Diversion terraces in some areas prevent overwash from higher elevations. The nearly level soils are not subject to erosion and consequently can be cultivated year after year under high-level management. The gently sloping soils need a suitable cropping system and conservation practices to control erosion.

CAPABILITY UNIT IIIw–86

Only Alluvial land, loamy, wet, is in this unit. It is a deep poorly drained or very poorly drained land type on flood plains. It is subject to frequent stream overflow.

This soil is medium to high in organic-matter content, medium in natural fertility, and strongly acid to neutral in reaction. Available water capacity is moderate to high, and permeability is moderately rapid. The seasonal water table is high, and water stands on the surface after heavy rains and during most of winter and spring.

Because this land is excessively wet and subject to frequent stream overflow, the range of suitable crops is limited. If drainage is provided, corn and soybeans are suitable. Ladino clover, alsike clover, reed canarygrass, and timothy are the better suited grasses and legumes.

Wetness and stream overflow are the main limitations to the use of this land for farming. Plowing or cultivating is often delayed in spring and after heavy rainfall. Open ditches and tile drains will remove the excess water in most places. Floods occasionally damage crops, but most are of short duration and occur before the regular growing season.

CAPABILITY UNIT IVe–55

This unit consists of deep, well-drained, moderately steep soils of the Athol, Duffield, Lansdale, Norton, and Quakertown series. These soils are on uplands. They formed in material weathered from red shale, sandstone, siltstone, limestone, and glacial till that was derived mainly from granite gneiss.

These soils are medium to low in organic-matter content, moderate to high in natural fertility, and neutral to strongly acid in reaction. Available water capacity is moderate or high. Permeability is moderate in the subsoil of Athol, Duffield, and Lansdale soils and moderately slow to slow in Norton and Quakertown soils.

Because of the moderately steep slopes, the rock outcrops, and the severe erosion hazard, these soils are not well suited to cultivation. The better suited grasses and legumes are orchardgrass, smooth bromegrass, timothy, alfalfa, ladino clover, and red clover. Corn and small grains can be grown occasionally in strips between areas of sod. The Duffield soils are not so steep as the other soils in this unit, but they have rock outcrops that obstruct farming operation.

CAPABILITY UNIT IVe–58

This unit consits of deep, well-drained, moderately steep to steep soils of the Edneyville, Hazleton, Legore, and Pattenburg series. These soils formed in material weathered from grainte gneiss, sandstone, diabase, and quartzose conglomerate.

These soils are low or medium in organic-matter content, low to moderate in nature fertility, and medium acid to strongly acid in reaction. Available water capacity is moderate to moderately low, and permeability is moderate to moderately rapid.

Because of the moderately steep slopes and the severe erosion hazard, these soils are not well suited to cultivated crops. Cultivated crops can be grown occasionally in strips between sod crops. The better suited grasses and legumes are alfalfa, orchardgrass, smooth bromegrass, birdsfoot trefoil, and bluegrass.

CAPABILITY UNIT IVe–65

This unit consists of moderately deep to deep, well-drained to somewhat poorly drained, moderately steep soils of the Berks, Lehigh, and Penn series. Berks and Penn soils are well drained. Lehigh soils are moderately well

drained to somewhat poorly drained. These soils are on uplands. They formed in material weathered from red, yellow, and brown shale siltstone; fine-grained sandstone; and metamorphosed shale.

These soils are medium in organic-matter content, moderate in natural fertility, and medium acid to strongly acid in reaction. Available water capacity ranges from low to high, and permeability is moderately rapid to slow in the subsoil.

Because of moderately steep slopes and a severe hazard of erosion, these soils are not well suited to tilled crops. The better suited grasses and legumes are alfalfa, ladino clover, red clover, birdsfoot trefoil, timothy, bromegrass, and orchardgrass. Small grain, corn, and soybeans can be grown occasionally in strips between areas of sod.

CAPABILITY UNIT IVe–66

Only Klinesville shaly loam, 4 to 12 percent slopes, is in this unit. This soil is well drained and gently sloping to sloping. It is shallow over shaly bedrock and therefore is droughty. This soil is on uplands. It formed in material weathered from shale.

This soil is medium in organic-matter content, low in natural fertility, and medium acid to strongly acid in reaction. Available water capacity is low, and permeability is moderately rapid throughout the profile.

This soil is poorly suited to row crops. It is better suited to small grain, perennial hay, and pasture. It is fair for alfalfa, tall fescue, orchardgrass, and birdsfoot trefoil. Pasture grasses and legumes that can be grown are ladino clover, red clover, timothy, and bromegrass.

Erosion is a moderately severe hazard and is extremely difficult to control.

CAPABILITY UNIT IVs–60

Parker cobbly loam, 3 to 15 percent slopes, is the only soil in this unit. It is a deep, excessively drained, gently sloping to sloping soil on uplands. It formed in material weathered from granite gneiss. This soil is medium in organic-matter content, moderate to low in natural fertility, and strongly acid in reaction. Available water capacity is low, and permeability is moderately rapid throughout the profile.

Because of low available water capacity and high content of cobblestones, this soil is not well suited to tilled crops. Legumes and grasses of ladino clover, red clover, birdsfoot trefoil, orchardgrass, bromegrass, and timothy are suitable under high-level management, as are small grain, corn, and soybeans.

The plow layer of this soil is in good tilth. The soil can be worked throughout a wide range of moisture content, but the many cobblestones and pebbles on the surface make tillage operations difficult.

CAPABILITY UNIT IVw–80

This unit consists of deep and moderately deep, poorly drained, neary level and gently sloping soils of the Croton series and Reaville series, wet variant. These soils are on upland flats and in depressions. They formed in material weathered from red shale, siltstone, or fine-grained standstone. Croton soils have a thick, dense fragipan in the lower part of the subsoil. This pan limits the depth of the rooting zone and restricts the movement of air and water.

These soils are medium in organic-matter content, moderate in natural fertility, and medium acid or strongly acid in reaction. Available water capacity is high to moderate, and permeability is slow in the subsoil.

The soils in this unit are poorly suited to many of the locally grown crops, such as corn, winter small grain, and alfalfa, because of wetness. Suitability of the soil for corn and soybeans can be improved to some degree by drainage, but the limitation of wetness cannot be overcome entirely. The soils are well suited to birdsfoot trefoil, reed canarygrass, and other grasses and legumes that tolerate wetness.

On gentle slopes there is a moderate hazard of erosion if the soil is tilled. Wetness is the main limitation if these soils are farmed. Water remains near the surface after heavy rains and during most of the winter and spring. The excessive wetness generally delays plowing and cultivation until late in spring. Open drainage ditches are effective in removing most of the surface water. Because of slow permeability in Croton soils and moderate depth to bedrock in Reaville soils, the effectiveness of tile drainage is severely limited in most places. Diversion terraces in some areas can prevent overwash from higher elevations.

CAPABILITY UNIT IVw–82

Cokesbury loam, is the only soil in this capability unit. It is a deep, poorly drained, nearly level soil on the uplands. This soil formed in material weathered from granite gneiss. A firm, compact, and brittle fragipan is in the lower part of the subsoil at a depth of about 25 inches. This pan limits depth of the rooting zone and restricts movement of air and water.

This soil is moderately high in organic-matter content, moderate in natural fertility, and medium acid or strongly acid in reaction. Available water capacity is high, and permeability of the subsoil is slow.

This soil is only fairly well suited to poorly suited to cultivated crops. Wetness makes it unsuitable for winter small grain and alfalfa. It is well suited to grass and legumes that tolerate wetness, such as birdsfoot trefoil, reed canarygrass, timothy, tall fescue, and ladino cover.

If farmed, wetness is the main limitation of this soil. Plowing and cultivation are often delayed in spring and after heavy rains. Open ditches are effective in removing excess surface water. Tile drainage systems generally are not effective in this soil because of the slowly permeable pan in the subsoil.

CAPABILITY UNIT Vw–78

Rowland silt loam is the only soil in this unit. It is a deep, moderately well drained to somewhat poorly drained, nearly level soil on the flood plains, where stream overflow is very frequent. This soil formed in alluvial material washed from areas underlain by shale, siltstone, and sandstone.

This soil is medium in organic-matter content, moderately high in natural fertility, and strongly acid to medium acid in reaction. Available water capacity is high, and permeability is moderate throughout the profile. It remains slightly wet because of a seasonal, moderately high water table.

Frequent flooding makes this soil poorly suited to cultivated crops. It is better suited to hay, pasture, and trees. It is especially well suited to pastures of bluegrass and ladino clover or to birdsfoot trefoil and bluegrass sods.

Winter small grain and alfalfa are not suited, because of frequent flooding and the seasonal, moderately high water table. Major concerns in managing this soil are flooding and the removal of excess water. Most areas are too small to justify the cost of levees. Some areas may need random tile drains to eliminate wetness. Land leveling or smoothing in some uneven areas will improve surface drainage.

CAPABILITY UNIT Vw-80

Watchung silt loam is the only soil in this capability unit. It is a deep, poorly drained, nearly level soil on uplands. It formed in material weathered from diabase.

This soil is medium in organic-matter content, moderate in natural fertility, and strongly acid in recation. Available water capacity is high. Permeability is slow in the subsoil, and the water table is high during much of the year. Runoff is slow, and the surface is sometimes ponded.

Extended periods of wetness cause this soil to be unsuitable for field and hay crops. Watchung soil is better suited to pastures of ladino clover, alsike clover, reed canarygrass, and birdsfoot trefoil. Grazing can be delayed in spring until the water table has receded. Wetness is the main limitation of this soil. Slow permeability in the subsoil makes drainage difficult. Drainage ditches are effective in removing most of the water. Because of slow permeability in the subsoil, drain tiles generally are not effective. In some areas terraces can be used to divert overwash and seepage water from higher elevations.

CAPABILITY UNIT VIe-66

Klinesville shally loam, 12 to 18 percent slopes, is the only soil in this unit. This soil is well drained, moderately steep, and shallow over shaly bedrock. It formed in material weathered from shale.

This soil is medium in organic-matter content, low in natural fertility, and medium acid to strongly acid in reaction. Available water capacity is low, and permeability is moderately rapid throughout the profile.

Moderately steep slopes, severe erosion hazard, and low available water capacity make this soil unsuitable for field crops. It is better suited to pasture, hay, trees, and wildlife habitat. Ladino clover, red clover, orchardgrass, timothy, bromegrass, and birdsfoot trefoil are the better suited grasses and legumes.

Because of the severe erosion hazard, plowing and other seedbed preparations should be held to a minimum. Grass and legume stands can be renovated by disking, fertilizing, and seeding instead of by plowing and preparing a seedbed. In places grazing needs to be controlled, especially in the first year of growth and during extremely dry periods.

CAPABILITY UNIT VIs-60

Parker cobbly loam, 15 to 25 percent slopes, is the only soil in this unit. It is a deep, excessively drained, steep soil on the uplands. It formed in material weathered from granite gneiss.

The soil is medium in organic-matter content, moderate to low in natural fertility, and strongly acid in reaction. Available water capacity is low. Permeability is moderately rapid in the surface layer and subsoil and rapid below.

The steep slopes, along with the severe erosion hazard and the many cobblestones, make this soil unsuited to cultivated crops and only fairly well suited to forage crops. Alfalfa, ladino clover, red clover, birdsfoot trefoil, orchardgrass, bromegrass, and timothy are suited under high-level management.

Pastures can be renovated by disking, fertilizing, and seeding instead of by plowing and preparing a seedbed. The use of tractors is limited on the steeper slopes. Grazing should be controlled, especially in the first year of growth and during extremely dry periods.

CAPABILITY UNIT VIs-61

This unit consists of deep, well-drained to somewhat poorly drained, gently sloping to moderately steep soils of the Duffield, Hazleton, Mount Lucas, and Neshaminy series. These soils are very stony or very rocky. They formed on uplands in material weathered from limestone, sandstone, and diabase.

These soils are medium in organic-matter content, moderate to high in natural fertility, and strongly acid to neutral in reaction. Available water capacity is moderate to high, and permeability is moderately rapid to slow in the subsoil.

These soils are not suited to cultivation, because of their high content of stone. In addition, in some places there are many outcrops of limestone. Furthermore, these soils are erodible if cultivated. They are moderately well suited to forage crops. Alfalfa, ladino clover, red clover, birdsfoot trefoil, orchardgrass, bromegrass, and timothy are the better suited legumes and grasses. In dry periods plants may suffer from the lack of adequate moisture.

The abundance of stones and rocks interferes with plowing. Pastures can be renovated by disking, fertilizing, and seeding, instead of by plowing and preparing a seedbed. In places grazing needs to be controlled in the first year of growth and during excessively wet and dry periods.

CAPABILITY UNIT VIs-75

This unit consists of deep, moderately well drained to somewhat poorly drained, nearly level to moderately steep soils of the Califon, Chalfont, and Lehigh series. These soils are very stony. They formed on uplands in materials weathered from argillite, metamorphosed shale, and glacial till consisting predominantly of granite gneiss. In the Califon and Chalfont soils, the lower part of the subsoil is a firm, compact, and brittle fragipan that limits depth of the rooting zone and restricts movement of air and water.

These soils generally are medium in organic-matter content, moderate in natural fertility, and strongly acid to medium acid in reaction. Available water capacity is high, and permeability is slow in the subsoil.

Because of the high content of stones, these soils are not suited to field crops or permanent hay. They are suited to pasture, trees, and wildlife habitat. Grasses and legumes well suited to these soils are ladino clover, red clover, birdsfoot trefoil, timothy, orchardgrass, and bromegrass.

Pastures generally can be renovated by disking, fertilizing, and seeding instead of by plowing and preparing a seedbed. Grazing should be controlled in the first year and during excessively wet and dry periods.

CAPABILITY UNIT VIw-86

Bowmansville silt loam is the only soil in this capability unit. It is a deep, somewhat poorly drained to poorly

drained, nearly level soil on flood plains. Flooding by stream overflow occurs very frequently. This soil formed in alluvial material washed from areas underlain by shale, siltstone, and sandstone.

This soil is medium in organic-matter content, moderate in natural fertility, and very strongly acid to strongly acid in reaction. Available water capacity is high, and permeability is moderate to moderately slow in the subsoil. Because of frequent flooding and poor drainage, this soil is not suited to field crops and hay. It is better suited to pastures of bluegrass, ladino clover, reed canarygrass, and birdsfoot trefoil.

Major concerns in managing are stream overflow and excess water in the soil. In places water from hillside seeps is added to this soil. Intercepting tile drains are effective in reducing wetness caused by seepage from adjacent slopes. Drainage ditches help to remove excess water. Land leveling or smoothing is used in places to improve surface drainage.

CAPABILITY UNIT VIIe–60

Pattenburg gravelly loam, 18 to 40 percent slopes, is the only soil in this unit. It is a deep, well-drained, steep to very steep, gravelly soil on uplands. It formed in material weathered from red quartzose conglomerate or fanglomerate.

This soil is low to medium in organic-matter content, low in natural fertility, and strongly acid in reaction. Available water capacity is moderately low, and permeability is moderately rapid in the subsoil.

Steep to very steep slopes, a severe hazard of erosion, and moderately low available water capacity make this soil unsuited to cultivated crops. It is only moderately suited to hay and pasture. Ladino clover, red clover, birdsfoot trefoil, orchardgrass, bromegrass, and timothy are the better suited legumes and grasses. Reforestation may be preferred in many areas.

The large amount of gravel in this soil makes tillage difficult. Because of the severe erosion hazard, plowing and other seedbed preparation should be held to a minimum. If possible, pastures should be renovated by disking, fertilizing, and then seeding instead of by plowing and preparing a seedbed. The operation of tractors is severely restricted on the steeper slopes. Wherever possible, tractors should be operated on the contour to help slow the runoff and thereby reduce erosion. Grazing should be controlled, especially during excessively wet or extremely dry periods.

CAPABILITY UNIT VIIs–61

The soils in this unit are deep, well-drained to excessively drained, gently sloping to very steep soils of the Edneyville, Hazleton, Neshaminy, and Parker series. These soils are very stony or extremely stony. They formed on uplands in material weathered from granite gneiss sandstone, diabase, and granite gneiss.

These soils are medium in organic-matter content, low to high in natural fertility, and medium acid to strongly acid in reaction. Available water capacity is low to high, and permeability is moderately slow to moderately rapid in the subsoil.

These soils generally are wooded, and they are better suited to growing trees than to other uses. Because of the high content of stone, they are not suited to cultivated crops, and their potential for pasture also is limited. Ladino clover, bromegrass, and orchardgrass are the most suitable pasture plants. The soils also can be used for wildlife habitat. The operation of tractors on these soils is difficult and, in places, impossible because of steep slopes, rock outcrops, or numerous stones.

CAPABILITY UNIT VIIs–67

This unit consists of Rough broken land, shale; Rock land, Edneyville material; and Steep stony land, Parker material. These land types formed in material weathered from granite gneiss, quartzite, red shale, argillite, and conglomerate. They are extremely variable in slope, texture, drainage, and suitability for farming.

Rough broken land, shale, is very steep and is along the Delaware River and in deep gorges of its tributaries. Massive outcrops of sandstone, shale, quartzite conglomerate, and argillite are common. Natural vegetation is mostly scattered trees and shrubs. This land type is not suited to cultivation or to pasture.

Rock land, Edneyville material, is in areas that have variable relief and numerous rock outcrops. This land type is not suited to field crops, hay, or pasture. The soil material between the outcrops generally is deep and is suited to trees. Marketable timber can be produced on this land type.

Steep stony land, Parker material, is in areas in the northern part of the county. Large numbers of stones and boulders are on the surface. The abundance of stones and boulders precludes the use of these areas for cultivated crops or pasture. The soil material between the stones generally is deep and is suited to trees. Marketable timber of good quality can be produced on this land type.

CAPABILITY UNIT VIIs–77

The soils in this unit are deep, moderately well drained to poorly drained, nearly level to gently sloping soils of the Cokesbury, Croton, Mount Lucas, and Watchung series. These are very stony soils on uplands. They formed in material weathered from diabase, granite gneiss, shale, and argillite.

These soils are medium or high in organic-matter content, moderate in natural fertility, and strongly acid to medium acid in natural reaction. Available water capacity is high, and permeability is slow in the subsoil. The water table is high during much of the year. Runoff is slow, and the surface is sometimes ponded. Because of the high content of stones and the high water table, these soils are not suited to field crops, hay, or pasture. The soil material between the stones generally is deep and is suited to trees.

Excess water can be effectively removed by drainage ditches.

Estimated yields

Estimated indexes, or ratings, of yields are given in table 2 for the principal crops grown on the soils in Hunterdon County under two levels of management. The lowest rating is 1, and the highest is 10. Table 3 shows how each rating is converted to a range in yield.

In table 2, the ratings in columns A are based on yields expected under the management used by most farmers in the county. Ratings in columns B are based on yields expected under the best current management for the crop on that soil. The ratings in columns B do not represent the highest yields obtained under ideal conditions but are

based on averages of yields obtained over a period of at least 4 years, allowing for exceptional weather and for pests and diseases. The differences between column A and column B for any crop may be the result of a single factor or a combination of factors. In general, all factors must be favorable to obtain yields represented by the ratings in columns B.

Details of the practices that are recommended to obtain high yields are changed somewhat from year to year. Current detailed recommendations are published each year in bulletins of the Agricultural Extension Service. In general, the recommended practices are: (1) Choosing varieties of crops that are suited to the soil and climate and that are resistant to the common pests and diseases; (2) treating seed by sterilizing or inoculating when appropriate; (3) planting seed at the proper rate and maintaining the proper number of plants per acre; (4) applying fertilizer after choosing the formula, the amount per acre, and the time of application in relation to the soil, crop, plant population, and amount of available water in the soil; (5) applying lime according to soil tests and needs of the crop; (6) controlling pests, diseases, and weeds; (7) installing drainage if the water table interferes with growth of crops; (8) applying practices to control runoff and erosion; (9) planting crops in an appropriate sequence, growing cover crops, and using minimum tillage where applicable; and (10) keeping the soil in good tilth.

Estimates for soils on which records are not available are based on yields from similar soils. The county agricultural agent and other agricultural leaders helped in making all the estimates.

Because the crops listed generally are not grown on them, the following miscellaneous land types are omitted from table 2: Made land; Rock land, Edneyville material; Rough broken land, shale; and Steep stony land, Parker material.

TABLE 2.—*Estimated average yield ratings of principal crops under two levels of management*

Ratings are from 1, the lowest, to 10, the highest. Yield equivalents for ratings are listed in table 3. Ratings in columns A are for common management; those in columns B, for the best current management. Absence of a rating indicates crop generally is not grown on the soil]

Soil	Corn				Wheat		Oats		Alfalfa		Mixed hay	
	Grain		Silage									
	A	B	A	B	A	B	A	B	A	B	A	B
Abbottstown silt loam, 0 to 2 percent slopes	4	6	4	6			4	6			6	8
Abbottstown silt loam, 2 to 6 percent slopes	4	6	4	6			4	6			6	8
Alluvial land, loamy	4	7	4	7								
Alluvial land, loamy, wet												
Annandale gravelly loam, 3 to 8 percent slopes	7	9	7	8	7	9	7	8	6	8	8	9
Annandale gravelly loam, 8 to 15 percent slopes, eroded	5	8	5	7	5.	8	5	7	5	7	7	8
Annandale and Edneyville gravelly loams, 3 to 8 percent slopes	5	8	5	8	8	9	7	8	6	7	6	8
Annandale and Edneyville gravelly loams, 8 to 15 percent slopes	5	7	5	7	7	8	6	7	4	6	5	7
Athol gravelly loam, 2 to 6 percent slopes	7	9	7	9	8	9	9	10	8	10	8	10
Athol gravelly loam, 6 to 12 percent slopes, eroded	6	8	6	8	7	8	8	9	8	9	8	10
Athol gravelly loam, 12 to 18 percent slopes, eroded	5	7	5	7	6	7	7	8	7	8	7	9
Bedington shaly silt loam, 2 to 6 percent slopes	7	9	7	9	8	9	8	9	7	9	8	10
Bedington shaly silt loam, 6 to 12 percent slopes, eroded	6	8	6	8	7	8	7	8	6	8	8	10
Berks shaly loam, 2 to 6 percent slopes	3	4	3	4	5	6	5	6	5	6	6	8
Berks shaly loam, 6 to 12 percent slopes, eroded	3	4	3	4	5	6	4	5	4	5	5	6
Berks shaly loam, 12 to 18 percent slopes, eroded	2	3	2	3	4	5	3	4	3	5	3	4
Birdsboro silt loam, 0 to 2 percent slopes	8	10	8	10	8	9	9	10	7	9	8	10
Birdsboro silt loam, 2 to 6 percent slopes	8	10	8	10	8	9	9	10	7	9	8	10
Birdsboro silt loam, 6 to 12 percent slopes, eroded	7	9	7	9	7	8	8	9	6	8	8	10
Bowmansville silt loam												
Bucks silt loam, 2 to 6 percent slopes	8	10	7	9	8	10	8	10	8	10	8	10
Bucks silt loam, 6 to 12 percent slopes, eroded	6	9	5	8	6	9	6	9	6	9	6	9
Califon loam, 0 to 3 percent slopes	6	8	6	8	6	7	6	7	6	8	7	9
Califon loam, 3 to 8 percent slopes	5	7	5	7	6	7	6	7	6	8	7	9
Califon very stony loam, 0 to 8 percent slopes												
Chalfont silt loam, 0 to 2 percent slopes	4	6	4	6			6	8			6	8
Chalfont silt loam, 2 to 6 percent slopes	4	6	5	6			6	8			6	8
Chalfont silt loam, 6 to 12 percent slopes, eroded	4	5	4	5							6	8

TABLE 2.—*Estimated average yield ratings of principal crops under two levels of management*—Continued

Soil	Corn				Wheat		Oats		Alfalfa		Mixed hay	
	Grain		Silage									
	A	B	A	B	A	B	A	B	A	B	A	B
Chalfont very stony silt loam, 2 to 12 percent slopes												
Chalfont-Lehigh very stony silt loams, 2 to 12 percent slopes												
Chalfont-Quakertown silt loams, 0 to 6 percent slopes	5	7	5	7	6	7	6	7	6	8	7	9
Cokesbury loam	3	4	3	4							5	7
Cokesbury very stony loam												
Croton silt loam, 0 to 2 percent slopes	2	3	2	3							4	6
Croton silt loam, 2 to 6 percent slopes	2	3	2	3							4	6
Croton very stony silt loam, 0 to 6 percent slopes												
Duffield silt loam, 2 to 6 percent slopes	8	10	8	10	9	10	9	10	8	10	8	10
Duffield silt loam, 6 to 12 percent slopes, eroded	7	9	7	9	8	9	6	9	7	10	7	10
Duffield rocky silt loam, 6 to 12 percent slopes, eroded	6	8	6	8	7	8	7	8	6	9	6	9
Duffield very rocky silt loam, 12 to 18 percent slopes, eroded												
Edneyville gravelly loam, 3 to 8 percent slopes	5	6	5	6	5	7	7	8	5	7	6	8
Edneyville gravelly loam, 8 to 15 percent slopes, eroded	3	5	4	5	3	6	5	8	4	6	4	7
Edneyville gravelly loam, 15 to 25 percent slopes					3	5	5	7	3	5	4	6
Edneyville and Parker extremely stony loams, 3 to 15 percent slopes												
Hazleton channery loam, 2 to 6 percent slopes	5	7	5	7	7	8	7	8	5	6	5	6
Hazleton channery loam, 6 to 12 percent slopes, eroded	4	6	4	6	6	7	6	7	5	6	5	6
Hazleton channery loam, 12 to 18 percent slopes	3	5	3	5	5	6	5	6	4	5	4	5
Hazleton very stony loam, 6 to 18 percent slopes												
Hazleton very stony loam, 18 to 40 percent slopes												
Klinesville shaly loam, 4 to 12 percent slopes		2		2	3	4	4	5	3	4	3	4
Klinesville shaly loam, 12 to 18 percent slopes					3	4	3	4	3	4	3	4
Lansdale loam, 0 to 6 percent slopes	6	8	6	8	7	8	7	8	6	8	6	8
Lansdale loam, 6 to 12 percent slopes, eroded	5	7	6	8	6	7	6	7	6	7	6	8
Lansdale loam, 12 to 18 percent slopes	4	6	5	7	5	6	5	6	5	6	5	7
Lansdowne silt loam, 0 to 6 percent slopes	4	6	4	6	6	7	7	8	6	7	6	8
Lawrenceville silt loam, 2 to 6 percent slopes	6	7	5	6	7	8	8	9	7	8	8	9
Lawrenceville silt loam, 6 to 12 percent slopes, eroded	4	6	4	6	6	7	7	8	6	7	6	8
Legore gravelly loam, 2 to 6 percent slopes	4	6	3	5	6	7	7	8	5	6	7	8
Legore gravelly loam, 6 to 12 percent slopes	3	5	2	4	5	6	6	7	4	5	5	6
Legore gravelly loam, 12 to 18 percent slopes	2	4	2	3	4	5	5	6	4	5	3	4
Lehigh silt loam, 2 to 6 percent slopes	4	5	4	5			5	6			5	7
Lehigh silt loam, 6 to 12 percent slopes, eroded	3	5	3	5	4	6	4	5			4	6
Lehigh silt loam, 12 to 18 percent slopes, eroded	3	4	3	4	3	5	3	4			4	6
Lehigh very stony silt loam, 2 to 6 percent slopes												
Lehigh very stony silt loam, 6 to 18 percent slopes												
Made land												
Meckesville gravelly loam, 2 to 6 percent slopes	6	8	6	8	8	9	8	9	7	8	8	9
Meckesville gravelly loam, 6 to 12 percent slopes, eroded	5	7	5	7	8	9	8	9	7	8	8	9
Mount Lucas silt loam, 0 to 6 percent slopes	5	7	5	7	7	8	8	9	6	7	7	8
Mount Lucas-Watchung very stony silt loams, 0 to 6 percent slopes												
Neshaminy gravelly loam, 2 to 6 percent slopes	8	10	8	10	9	10	9	10	8	10	8	10
Neshaminy silt loam, 2 to 6 percent slopes	8	10	8	10	9	10	9	10	8	10	8	10
Neshaminy silt loam, 6 to 12 percent slopes, eroded	7	9	7	9	7	9	8	9	6	9	7	10
Neshaminy very stony silt loam, 2 to 12 percent slopes												
Neshaminy very stony silt loam, 12 to 18 percent slopes												
Neshaminy very stony silt loam, 18 to 40 percent slopes												

TABLE 2.—*Estimated average yield ratings of principal crops under two levels of management*—Continued

Soil	Corn				Wheat		Oats		Alfalfa		Mixed hay	
	Grain		Silage									
	A	B	A	B	A	B	A	B	A	B	A	B
Neshaminy-Mount Lucas very stony silt loams, 2 to 12 percent slopes												
Norton loam, 2 to 6 percent slopes	6	8	5	7	6	8	6	8	5	8	7	9
Norton loam, 6 to 12 percent slopes, eroded	4	7	3	6	4	7	4	7	4	8	6	8
Norton loam, 12 to 18 percent slopes, eroded	4	6	4	6	6	7	6	7	6	8	6	8
Parker cobbly loam, 3 to 15 percent slopes	2	3	2	3	4	5	4	5	3	4	3	4
Parker cobbly loam, 15 to 25 percent slopes	2	3	2	3	3	4	3	4	2	3	2	3
Pattenburg gravelly loam, 2 to 6 percent slopes	4	5	4	6	4	6	4	6	4	5	4	6
Pattenburg gravelly loam, 6 to 12 percent slopes, eroded	2	4	3	5	3	5	3	5	3	4	3	5
Pattenburg gravelly loam, 12 to 18 percent slopes		3			2	4	2	4	2	3	2	4
Pattenburg gravelly loam, 18 to 40 percent slopes												
Pattenburg gravelly loam, moderately wet, 2 to 6 percent slopes	3	4	3	4			3	5	3	4	3	4
Penn shaly silt loam, 2 to 6 percent slopes	5	6	5	6	5	7	6	8	6	8	6	8
Penn shaly silt loam, 6 to 12 percent slopes, eroded	3	5	4	6	5	6	5	7	6	8	6	8
Penn shaly silt loam, 12 to 18 percent slopes	2	4	2	4	4	5	4	6	5	7	5	7
Penn-Bucks complex, 2 to 6 percent slopes	5	7	5	7	6	8	7	9	8	9	8	9
Penn-Bucks complex, 6 to 12 percent slopes, eroded	4	6	4	6	5	7	6	8	7	8	7	8
Pope fine sandy loam, high bottom	5	7	5	7	7	8	7	8	5	7	6	7
Quakertown silt loam, 0 to 2 percent slopes	7	9	7	9	8	9	8	9	7	9	8	10
Quakertown silt loam, 2 to 6 percent slopes	7	9	6	8	7	9	7	9	7	9	8	10
Quakertown silt loam, 6 to 12 percent slopes, eroded	5	8	5	7	5	8	5	8	6	8	7	9
Quakertown silt loam, 12 to 18 percent slopes, eroded	3	7	4	6	3	7	3	7	5	7	6	8
Quakertown-Chalfont silt loams, 6 to 12 percent slopes, eroded	4	7	4	6	4	7	4	7	5	7	6	8
Raritan silt loam, 0 to 2 percent slopes	5	7	4	6	6	7	6	7	6	7	6	8
Raritan silt loam, 2 to 6 percent slopes	5	7	4	6	6	7	6	7	6	7	6	8
Readington silt loam, 2 to 6 percent slopes	5	7	4	6	7	8	7	8	4	6	7	8
Readington silt loam, 6 to 12 percent slopes, eroded	4	6	3	5	6	7	6	7	4	6	7	8
Reaville silt loam, 0 to 2 percent slopes	3	4	3	4			4	6			4	6
Reaville silt loam, 2 to 6 percent slopes	3	4	3	4			4	6			4	6
Reaville silt loam, 6 to 12 percent slopes, eroded	2	4	2	4			4	5			3	5
Reaville silt loam, wet variant, 0 to 2 percent slopes	2	3	2	3							3	5
Reaville silt loam, wet variant, 2 to 6 percent slopes	2	3	2	3							3	5
Riverhead gravelly sandy loam, 2 to 6 percent slopes	4	6	4	6	6	7	7	8	4	6	4	6
Riverhead gravelly sandy loam, 6 to 18 percent slopes					5	6	6	7	4	5	4	5
Rock land, Edneyville material												
Rough broken land, shale												
Rowland silt loam		4										
Steep stony land, Parker material												
Turbotville loam, 2 to 6 percent slopes	5	7	5	7	7	8	7	8	4	6	5	7
Washington loam, 2 to 6 percent slopes	8	10	7	9	8	10	8	10	8	10	8	10
Washington loam, 6 to 12 percent slopes, eroded	7	9	7	9	8	10	8	10	8	10	8	10
Watchung silt loam												

TABLE 3.—*Rating-yield per acre conversion table*

[The symbol > means more than]

Rating [1]	Crop					
	Corn		Wheat	Oats	Alfalfa	Mixed hay
	Grain	Silage				
	Bu.	*Tons*	*Bu.*	*Bu.*	*Tons*	*Tons*
1	50–60	10–12	10–15	35–40	1. 0–1. 5	1. 2–1. 5
2	60–70	12–14	15–20	40–45	1. 5–2. 0	1. 5–1. 8
3	70–80	14–16	20–25	45–50	2. 0–2. 5	1. 8–2. 0
4	80–90	16–18	25–30	50–55	2. 5–3. 0	2. 0–2. 2
5	90–100	18–20	30–35	55–60	3. 0–3. 5	2. 2–2. 5
6	100–110	20–22	35–40	60–65	3. 5–4. 0	2. 5–2. 8
7	110–120	22–24	40–45	65–70	4. 0–4. 5	2. 8–3. 0
8	120–130	24–26	45–50	70–75	4. 5–5. 0	3. 0–3. 2
9	130–140	26–28	50–55	75–80	5. 0–5. 5	3. 2–3. 5
10	>140	>28	>55	>80	>5. 5	>3. 5

[1] A rating of 1 may be less than the yield shown.

Woodland

At one time Hunterdon County was predominantly a forest of oak trees. At present about a third of the county, about 90,000 acres, is forest (fig. 17). Idle land reseeds naturally to redcedar and ash. Oaks also seed in and eventually dominate this idle land. Yellow-poplar and ash are important species in places.

To help in planning the management of woodland, the soils of the county have been placed in 15 woodland groups. A group consists of soils that have about the same suitability for trees, that require about the same management, and are about the same in potential productivity. Each group has a symbol made up of Arabic numerals and a lowercase letter. The first numeral in the symbol identifies the woodland suitability class; placement in a class depends on potential productivity as explained in the paragraphs on site index that follows. The lowercase letter identifies a subclass. Placement in a subclass is in accordance with soil characteristics and physiographic characteristics that constitute significant hazards or limitations in the use and management of woodland. The letter *x* stands for stoniness or rockiness; *w*, for excessive wetness; *t*, for toxic substances; *d*, for restricted rooting depth; *c*, for clayey textures; *s*, for sandy texture; *f*, for fragmental or skeletal soils; *r*, for unfavorable relief or slope; and *o*, for slight limitations, or none.

Figure 17.—Wooded area on Cushetunk Mountain. The soil is a Neshaminy very stony silt loam, in woodland group 2o1.

Table 4 gives brief descriptions of the significant characteristics of the soils in each group; identifies the soils by their map symbols; and gives information concerning site index, species suitability, and hazards that affect woodland management.

Site index is a term used to express productivity. It is the height attained at 50 years of age by the dominant trees in a well-managed stand (natural or planted) that has not been damaged by disease, insect infestation, or fire. Because site index plots in the county were not available for many of the soils and kinds of trees, information gathered on the soil in other areas was used to estimate the site index classes. Site index curves were available for oak (*8*) and yellow-poplar (*4*).

The placement of a soil in a woodland group depends on the potential productivity of the soils, as indicated by the average site index of an indicator species. The first Arabic numeral of the group symbol identifies the woodland group. For yellow-poplar, a site class of 1 indicates a site index of 95 or higher; a site class of 2 indicates a site-index range of 85 to 95; a site class of 3, a site-index range of 75 to 85; a site class of 4, a site-index range of 65 to 75; and a site class of 5, a site index of 65 or lower. For upland oaks, a site class of 1 indicates a site index of 85 or higher; a site class of 2 indicates a site-index range of 75 to 85; a site class of 3, a site-index range of 65 to 75; a site class of 4, a site-index range of 55 to 65; and a site class of 5, a site index of 55 or lower. The relation of site index to yield is shown in table 5.

TABLE 4.—*Factors in woodland management*

[Made land (Ma) was not placed in a woodland group, because its properties vary so much that onsite investigation is necessary to d

Woodland group	Average site index	Suitable species—		Limitations and hazard		
		To favor in existing stands	For planting	Seedling mortality	Plant competition	Equipment limitation
Group 1ol: Deep, well-drained soils; high available water capacity; slope range, 0 to 12 percent. DuB, DuC2, DvC2, Pk, WaB, WaC2.	Upland oaks, 85+; yellow-poplar, 95+.	Red oak, black walnut, yellow-poplar, ash.	White pine, black walnut, yellow-poplar, larch, Norway spruce.	Slight	Moderate	Slight
Group 1wl: Deep, poorly drained soils; high available water capacity; subject to frequent flooding; slope range, 0 to 2 percent. Bt, Wc.	Pin oak, 85+	Pin oak, sycamore, red maple.	White pine, loblolly pine, white spruce.	Severe	Severe	Severe
Group 1xl: Deep, well-drained, very rocky soils; slope range, 12 to 18 percent. DwD2.	Upland oaks, 85+; yellow-poplar, 95+.	Red oak, black walnut, yellow-poplar, ash.	White pine, black walnut, yellow-poplar, larch, Norway spruce.	Slight	Moderate	Moderate
Group 2ol: Deep soils; high or moderate available water capacity; slope range, 0 to 18 percent. AnB, AnC2, ApB, ApC, AtB, AtC2, AtD2, BaB, BaC2, BdA, BdB, BdC2, BuB, BuC2, EdB, EdC2, MeB, MeC2, NdB, NeB, NeC2, NhC, NhD, NkC, PbB, PbC2, PbD, QkA, QkB, QkC2, QkD2, QlC2.	Upland oaks, 75–85+; yellow-poplar, 85–95+.	Yellow-poplar, red oak, black walnut, ash.	White pine, yellow-poplar, loblolly pine, black walnut, Austrian pine, Norway spruce, larch.	Slight	Moderate for conifers. Severe for hardwoods.	Slight
Group 2rl: Deep, well-drained soils; moderate or moderately low available water capacity; slope range, more than 15 percent. EdD, NhE, PbE.	Upland oaks, 75–85; yellow-poplar, 85–95.	Red oak, yellow-poplar, ash.	White pine, yellow-poplar, larch, Norway spruce, Austrian pine.	Slight	Slight or moderate.	Moderate

Group 2w1: Deep, moderately well drained and somewhat poorly drained soils on uplands; high or moderate available water capacity; slope range, 0 to 12 percent. CaA, CaB, CbB, LeB, LeC2, MoB, MwB, PcB, TuB.	Upland oaks, 75–85; yellow-poplar, 85–95.	Red oak, yellow-poplar, ash, Virginia pine.	White pine, Norway spruce, yellow-poplar, loblolly pine.	Slight	Moderate for hardwoods. Severe for conifers.	Slight or moderate.	
Group 2w2: Deep, moderately well drained or somewhat poorly drained soils on flood plains; subject to occasional or frequent flooding; slope range, 0 to 2 percent. Ac, Ae, Ro.	Upland oaks, 75–85.	Red oak, ash, pin oak.	Pin oak, white pine.	Slight	Moderate for hardwoods. Severe for conifers.	Moderate	
Group 2x1: Deep, well-drained, extremely stony soils and very rocky land that have moderate to low available water capacity; slope range, 3 to 40 percent. EeC, Rk.	Upland oaks, 75–85.	Red oak, ash.	White pine, larch, Norway spruce, Austrian pine.	Slight	Slight or moderate.	Moderate	
Group 3o1: Deep or moderately deep, well-drained soils; low to high available water capacity; slope range, 0 to 18 percent. LaB, LaC2, LaD, LgB, LgC, LgD, NoB, NoC2, NoD2, PeB, PeC2, PeD, PfB, PfC2, RgB, RgC.	Upland oaks, 65–75.	Red oak	White pine, red pine, Virginia pine, shortleaf pine.	Slight	Slight for hardwoods. Moderate for conifers.	Slight	
Group 3f1: Deep, well-drained soils containing much gravel, shale, or cobblestones; low available water capacity; slope range, 2 to 40 percent. BbB, BbC2, BbD2, HaB, HaC2, HaD, HcC, PaC, SpF.	Upland oaks, 65–75.	Red oak, black oak, scarlet oak.	White pine, larch, Austrian pine, Norway spruce.	Moderate	Slight	Slight	
Group 3r1: Deep soils; moderate or low available water capacity; slope range, 15 to 40 percent. HcE, PaD.	Upland oaks, 65–75.	Red oak, black oak, scarlet oak.	White pine, larch, Austrian pine, Norway spruce.	Moderate	Slight for hardwoods. Moderate for conifers.	Moderate	
Group 3w1: Deep, moderately well drained, somewhat poorly drained, and poorly drained soils; high available water capacity; slope range, 0 to 18 percent. AbA, AbB, CdA, CdB, CdC2, CeB, CfC, CgB, Co, Cp, CrA, CrB, CsB, LbB, LhB, LhC2, LhD2, LkB, LkC, RbA, RbB, RcB, RcC2.	Upland oaks, 65–80; yellow-poplar, 75–85.	Red oak, ash, pin oak, yellow-poplar.	White pine, larch, Norway spruce, loblolly pine, white spruce. For Cokesbury and Croton soils, use only white pine or white spruce.	Severe for Cokesbury and Croton soils. Slight for others.	Moderate or severe for conifers. Slight to severe for hardwoods.	Moderate or severe.	

TABLE 4.—*Factors in woodland management*—Continued

Woodland group	Average site index	Suitable species—		Limitations and hazard		
		To favor in existing stands	For planting	Seedling mortality	Plant competition	Equipment limitation
Group 4d1: Well-drained, shallow, shaly soils; low available water capacity; slope range, 4 to 18 percent. KIC, KID.	Upland oaks, 55–65; Virginia pine, 55–65.	Virginia pine, black oak, chestnut oak.	Virginia pine, white pine.	Moderate	Slight	Slight
Group 4w1: Moderately deep, moderately well drained to poorly drained soils; slope range, 0 to 12 percent. ReA, ReB, ReC2, RfA, RfB.	Upland oaks, 55–65; Virginia pine, 55–65.	Red oak, Virginia pine, redcedar.	Virginia pine, white pine.	Moderate	Severe for conifers. Moderate for hardwoods.	Moderate
Group 5d1: Very steep, shallow to shale lands. RlF.	Upland oaks, 45–55.	Uplands oaks	White pine, Virginia pine.	Severe	Slight	Severe

TABLE 5.—*Yields from upland oaks and yellow-poplar in fully stocked, natural stands*

Site index	Age of stand	Yield			
		Upland oaks		Yellow-poplar	
	Years	*Board feet*	*Cords*	*Board feet*	*Cords*
50	30	300	6		
	40	1, 300	13		
	50	2, 900	19		
	70	7, 400	30		
60	20				
	30	800	10	900	8
	40	2, 900	19	2, 400	15
	50	5, 700	26	5, 100	21
	70	11, 600	39		
70	20			600	7
	30	1, 600	15	2, 400	15
	40	5, 000	25	5, 100	23
	50	8, 800	33	10, 300	31
	70	16, 000	47		
80	20			1, 100	10
	30	3, 000	20	4, 900	21
	40	7, 800	31	10, 200	31
	50	12, 400	41	16, 000	41
	70	21, 000	56		
90	20			1, 800	13
	30	4, 600	24	7, 800	27
	40	10, 800	37	14, 800	39
	50	16, 000	48	22, 100	52
	70	26, 200	65		
100	20			3, 100	17
	30			11, 000	32
	40			19, 600	47
	50			29, 100	62
	70				

Species suitability in table 4 refers to the kinds of native trees that should be favored in management and the kind of trees that are suitable for planting.

Seedling mortality refers to the loss of naturally occurring or planted seedlings attributable to soil properties or topographic conditions when plant competition is not a factor. Seedling mortality is rated *slight* if 0 to 25 percent of the seedlings can be expected to die and *moderate* if the percentage is between 25 and 50. If more than 50 percent of the seedlings can be expected to die, seedling mortality is *severe.*

Plant competition refers to the rate at which brush, grass, and undesirable trees are likely to invade. Plant competition is rated *slight* if unwanted plants do not prevent adequate natural regeneration and early growth and do not interfere with the growth of planted seedlings. It is rated *moderate* if competing plants delay but do not prevent establishment of a normal, fully stocked stand through natural regeneration or through planting. Competition is rated *severe* if natural or artificial regeneration is not adequate without intensive site preparation and maintenance that includes weeding.

Equipment limitation is based on the degree to which steep slopes, stones, and excess water limit the use of ordinary equipment in pruning, thinning, harvesting, and other woodland management operations. The rating is *slight* if there are very few limitations on the type of equipment or on the time of year that the equipment can be used. It is *moderate* if slopes are moderately steep, if heavy equipment is restricted by wetness during the wettest periods, or if the equipment causes moderate damage to roots. Equipment limitations are *severe* if many types of equipment cannot be used, if the use of equipment is limited for more than 3 months in a year, or if the use of the equipment causes severe damage to tree roots and to the structure of the soils.

Erosion hazard is rated for well-managed woodland that is not protected by special practices. The hazard is *slight* if only a small loss of soil is to be expected, even when trees are harvested. The erosion hazard is *moderate* if a moderate loss of soil is to be expected if runoff is not controlled and vegetative cover is not adequate for protection. If the erosion hazard is *moderate*, moderate conservation practices are needed on skid trails and logging roads immediately after trees are harvested. The erosion hazard is *severe* if steep slopes, rapid runoff, and slow infiltration and permeability make the soil susceptible to severe erosion. In such areas harvesting and other operations should be performed across the slope as much as possible. It is advisable to lay out skid trails and logging roads on mild slopes so that excess water is disposed of safely during logging operations. Immediately after logging, practices to control erosion are needed on the logging roads and skid trails.

Windthrow hazard is rated on the basis of characteristics that affect the development of roots and on how firmly the roots anchor the trees to protect them against the force of the wind. The windthrow hazard is *slight* if no trees are likely to be blown down by a normal wind. It is *moderate* if roots hold the tree firmly except when the soil is excessively wet and the velocity of the wind is high. The hazard is *severe* if rooting is not deep enough to give stability, many trees are likely to be blown down if the soil is very wet or the wind is high, and individual trees are likely to be blown over if they are released on all sides.

Wildlife [2]

Wildlife contributes directly and indirectly to the economy of the county. Pheasant, rabbit, and whitetail deer are the major game species in Hunterdon County. Songbirds and other wildlife are an important part of the environment in suburban and semirural living areas of the county.

The wildlife population of any area depends on the availability of food, cover, and water in a suitable combination. Habitat for an individual bird or animal species or group of species is created, improved, or maintained by establishing or maintaining vegetation for food and cover.

In table 6, each of the soils in Hunterdon County is rated as to its suitability for eight elements of wildlife habitat and for overall suitability as habitat for three groups of wildlife: openland wildlife, woodland wildlife, and wetland wildlife. Of the 274,800 acres surveyed in Hunterdon County, 123,600 acres, or 45 percent, is rated *well suited* to openland wildlife; 82,400 acres, or 30 percent, is rated *suited;* and 68,700 acres, or 25 percent, is rated *poorly suited* or *unsuited.* For woodland wildlife, 118,100 acres, or 43 percent, is rated *well suited;* 123,600 acres, or 45 percent, is rated *suited;* and 33,000 acres, or 12 percent, is

[2] By EUGENE A. WHITAKER, biologist, Soil Conservation Service.

rated *poorly suited* or *unsuited.* For wetland wildlife, only 5,500 acres, or 2 percent, is rated *well suited;* 13,700 acres, or 5 percent, is rated *suited;* but 55,600 acres, or 93 percent, is rated *poorly suited* or *unsuited.*

In table 6 the meaning of the numerical ratings are: 1, indicates *well suited;* 2, *suited;* 3, *poorly suited;* and 4, *unsuited. Well suited* means that the habitat is easily created, improved, and maintained; the soil has few or no limitations that affect management; and satisfactory results can be expected. *Suited* means habitat can be created, improved, or maintained in most places; the soil has moderate limitations that affect management; and moderate intensity of management and fairly frequent attention are needed for satisfactory results. *Poorly suited* indicates that habitat can be created, improved, or maintained but the soil has rather severe limitations that make management difficult and expensive, and necessitate intensive effort; results are not always satisfactory. *Unsuited* indicates that it is impractical or impossible to create, improve, or maintain wildlife habitat on the soil named.

The information in table 6 can be of use in planning parks, wildlife refuges, nature study areas, and other recreational developments, as well as in identifying areas suitable for management as wildlife habitat and determining the relative intensity of management needed.

Elements of wildlife habitat

Ratings for elements of wildlife habitat are based solely on soil characteristics. They do not take into account the present uses of the soils or the distribution of wildlife and human populations. For this reason, an onsite inspection should be made before the development of any given acreage for wildlife habitat is planned. The ratings for Made land are not considered reliable, because the properties of this unit vary too much. The eight elements rated are explained in the following paragraphs.

Grain and seed crops.—The soils are rated according to their suitability for producing corn, sorghum, millet, soybeans, wheat, barley, and other grains used as food by wildlife.

Grasses and legumes.—The soils are rated according to their suitability for producing introduced grasses, herbaceous legumes, and other forage commonly grown in Hunterdon County. Cultivated grasses and legumes valuable for wildlife food and cover include alfalfa, clover, lespedeza, bluegrass, bromegrass, redtop, fescue, and orchardgrass.

Wild herbaceous upland plants.—The soils are rated according to their suitability for producing native or introduced perennial grasses and forbs (weeds) that provide food and cover principally for upland wildlife and that are established mainly through natural processes. Examples of these plants are lespedeza, barnyardgrass, pokeweed, foxtail, beggarweed, and goldenrod.

Hardwood woody plants.—The soils are rated according to their suitability for producing hardwood trees and shrubs that make vigorous growth and produce food and cover for wildlife. Examples of these are oak, beech, hickory, cherry, dogwood, viburnum, maple, honeysuckle, greenbrier and other briers, and autumn-olive.

Coniferous woody plants.—The soils are rated according to their suitability for producing coniferous trees and shrubs used mainly by wildlife as cover but often furnishing food in the form of browse, seeds, or fruit-like cones. These commonly become established through natural processes; but spruce, pines, cedars, hemlock, and yews can be planted.

Wetland food and cover plants.—The soils are rated according to their suitability for producing food and cover for waterfowl and fur-bearing animals. Annual and biennial plants are especially important in this habitat. Examples are smartweed, wild millet, reed, burreed, bulrush, sedge, switchgrass, cordgrass, pondgrass, duckweed, and cattail.

Shallow water developments.—The soils are rated according to their suitability for the construction of impoundments or excavations, or for control of water, generally to a depth not exceeding 5 feet. Examples are low dikes or levees, shallow dugout ponds, level ditches, and devices to control the water level of marshy areas.

Excavated ponds.—The soils are rated according to their suitability for dugout ponds or a combination of dugout ponds and low dikes that provide water of suitable quality, of suitable depth, and of ample quantity for fish or wildlife. Depth usually averages 6 feet in at least one-fourth of the area. The soils should have a permanent high water table or should provide some other dependable source of unpolluted water. Areas subject to frequent overflow are rated not suitable.

Classes of wildlife

Ratings of soils showing their suitability for the different kinds of wildlife were made by evaluating their ratings for selected elements of habitat. Weighted values based on the relative importance of each of these elements were used in rating the soils for kinds of wildlife. The kinds of wildlife, as listed in table 6, are defined in the following paragraphs.

Openland wildlife.—Birds and mammals that normally frequent cropland, meadows, lawns, and areas overgrown with grasses, herbs, and shrubby growth. Examples are pheasants, meadowlarks, field sparrows, red-winged blackbirds, cottontail rabbits, red foxes, and woodchucks. The elements of habitat that were considered most important for openland wildlife are grain and seed crops, grasses and legumes, wild herbaceous upland plants, and hardwood woody plants.

Woodland wildlife.—Birds and mammals that normally frequent areas wooded with hardwood trees and shrubs, coniferous trees and shrubs, or a mixture of such plants. Examples are ruffed grouse, thrushes, vireos, scarlet tanagers, towhees, gray and red squirrels, gray foxes, whitetailed deer, and raccoons. The kinds of habitat that were considered most important to woodland wildlife are grasses and legumes, wild herbaceous upland plants, hardwood woody plants, and coniferous woody plants.

Wetland wildlife.—Birds and mammals that normally frequent wet areas, such as ponds, marshes, and swamps. Examples are black ducks, wood ducks, herons, shore birds, minks, muskrats, and beavers. The kinds of habitat that were considered most important for wetland wildlife are wetland food and cover plants, shallow water developments, and excavated ponds.

TABLE 6.—*Suitability of the soils for elements of wildlife habitat and for kinds of wildlife*

[Soils rated 1 are well suited; 2, suited; 3, poorly suited; and 4, unsuited]

Soil series and map symbols	Elements of wildlife habitat								Kinds of wildlife		
	Grain and seed crops	Grasses and legumes	Wild herbaceous upland plants	Hardwood woody plants	Coniferous woody plants	Wetland food and cover plants	Shallow-water developments	Excavated ponds	Openland wildlife	Woodland wildlife	Wetland wildlife
Abbottstown:											
AbA	2	2	1	1	3	2	2	3	2	2	2
AbB	2	2	1	1	3	3	4	4	2	2	4
Alluvial land, loamy:											
Ac	2	2	1	1	3	3	2	3	2	2	3
Alluvial land, loamy, wet:											
Ae	3	2	2	1	3	2	2	4	2	2	2
Annandale:											
AnB, AnC2	2	1	1	1	3	4	4	4	1	1	4
Annandale and Edneyville:											
ApB, ApC	2	1	1	1	3	4	4	4	1	1	4
Athol:											
AtB, AtC2	2	1	1	1	3	4	4	4	1	1	4
AtD2	3	2	1	1	3	4	4	4	2	2	4
Bedington:											
BaB, BaC2	2	1	1	1	3	4	4	4	1	1	4
Berks:											
BbB, BbC2	2	1	1	2	2	4	4	4	1	2	4
BbD2	3	2	1	2	2	4	4	4	2	2	4
Birdsboro:											
BdA	1	1	1	1	3	4	4	4	1	1	4
BdB, BdC2	2	1	1	1	3	4	4	4	1	1	4
Bowmansville:											
Bt	4	3	3	1	3	1	2	4	3	2	2
Bucks:											
BuB, BuC2	2	1	1	1	3	4	4	4	1	1	4
Califon:											
CaA	2	1	1	1	3	3	3	3	1	1	3
CaB	2	1	1	1	3	3	4	4	1	1	4
CbB	4	3	1	1	3	3	4	4	3	2	4
Chalfont:											
CdA	2	2	1	1	3	2	2	2	2	2	2
CdB	2	2	1	1	3	3	4	4	2	2	4
CdC2	2	2	1	1	3	4	4	4	2	2	4
CeB	4	3	1	1	3	3	4	4	3	2	4
Chalfont-Lehigh:											
CfC	4	3	1	1	3	3	4	4	3	2	4
Chalfont-Quakertown:											
CgB	2	2	1	1	3	3	4	4	2	2	4
Cokesbury:											
Co	3	2	2	1	3	1	2	2	2	2	1
Cp	4	3	2	1	3	1	2	2	3	2	1
Croton:											
CrA	3	2	2	1	3	1	1	3	2	2	1
CrB	3	2	2	1	3	3	4	4	2	2	4
CsB	4	3	2	1	3	3	4	4	3	2	4
Duffield:											
DuB, DuC2, DvC2	2	1	1	1	3	4	4	4	1	1	4
DwD2	4	3	1	2	3	4	4	4	3	2	4
Edneyville:											
EdB, EdC2	2	1	1	1	3	4	4	4	1	1	4
EdD	3	2	1	1	3	4	4	4	2	2	4
EeC	4	4	1	1	3	4	4	4	3	2	4
Hazleton:											
HaB, HaC2	2	1	1	1	3	4	4	4	1	1	4
HaD	3	2	1	1	3	4	4	4	2	2	4
HcC, HcE	4	3	1	1	3	4	4	4	3	2	4
Klinesville:											
KlC, KlD	3	3	2	2	2	4	4	4	3	2	4
Lansdale:											
LaB, LaC2	2	1	1	1	3	4	4	4	1	1	4
LaD	3	2	1	1	3	4	4	4	2	2	4

TABLE 6.—*Suitability of the soils for elements of wildlife habitat and for kinds of wildlife*—Continued

Soil series and map symbols	Elements of wildlife habitat								Kinds of wildlife		
	Grain and seed crops	Grasses and legumes	Wild herbaceous upland plants	Hardwood woody plants	Coniferous woody plants	Wetland food and cover plants	Shallow-water developments	Excavated ponds	Openland wildlife	Woodland wildlife	Wetland wildlife
Lansdowne:											
LbB	2	2	1	1	3	3	4	4	2	2	4
Lawrenceville:											
LeB	2	1	1	1	3	3	4	4	1	1	4
LeC2	2	1	1	1	3	4	4	4	1	1	4
Legore:											
LgB, LgC	2	1	1	1	3	4	4	4	1	1	4
LgD	3	2	1	1	3	4	4	4	2	2	4
Lehigh:											
LhB, LhC2	2	2	1	1	3	3	4	4	2	2	4
LhD2	3	2	1	1	3	4	4	4	2	2	4
LkB	4	3	1	1	3	3	4	4	3	2	4
LkC	4	3	1	1	3	4	4	4	3	2	4
Made land:											
Ma	3	3	3	2	3	4	4	4	3	2	4
Meckesville:											
MeB, MeC2	2	1	1	1	3	4	4	4	1	1	4
Mount Lucas:											
MoB	2	2	1	1	3	3	4	4	2	2	4
Mount Lucas-Watchung:											
MwB	4	3	1	1	3	3	4	4	3	2	4
Neshaminy:											
NdB, NeB, NeC2	2	1	1	1	3	4	4	4	1	1	4
NhC, NhD, NhE	4	3	1	1	3	4	4	4	3	2	4
Neshaminy-Mount Lucas:											
NkC	4	3	1	1	3	4	4	4	3	2	4
Norton:											
NoB, NoC2	2	1	1	1	3	4	4	4	1	1	4
NoD2	3	2	1	1	3	4	4	4	2	2	4
Parker:											
PaC, PaD	3	3	3	3	1	4	4	4	3	3	4
Pattenburg:											
PbB, PbC2	2	2	1	1	3	4	4	4	1	1	4
PbD	3	2	1	1	3	4	4	4	2	2	4
PbE	4	3	1	1	3	4	4	4	3	2	4
Pattenburg, moderately wet:											
PcB	2	2	1	1	3	3	4	4	2	2	4
Penn:											
PeB, PeC2	2	1	1	1	3	4	4	4	1	1	4
PeD	3	2	1	1	3	4	4	4	2	2	4
Penn-Bucks:											
PfB, PfC2	2	1	1	1	3	4	4	4	1	1	4
Pope:											
Pk	1	1	1	1	3	4	4	4	1	1	4
Quakertown:											
QkA	1	1	1	1	3	4	4	4	1	1	4
QkB, QkC2	2	1	1	1	3	4	4	4	1	1	4
QkD2	3	2	1	1	3	4	4	4	2	2	4
Quakertown-Chalfont:											
QlC2	2	1	1	1	3	4	4	4	2	1	4
Raritan:											
RbA	2	2	1	1	3	2	2	2	2	2	2
RbB	2	2	1	1	3	3	4	4	2	2	4
Readington:											
RcB, RcC2	2	2	1	1	3	3	4	4	2	2	4
Reaville:											
ReA	2	2	1	1	3	2	2	2	2	2	2
ReB	2	2	1	1	3	3	4	4	2	2	4
ReC2	2	2	1	1	3	4	4	4	2	2	4
Reaville, wet variant:											
RfA	3	2	2	1	3	1	2	4	2	2	2
RfB	3	2	2	1	3	3	4	4	2	2	4
Riverhead:											
RgB, RgC	2	1	1	1	3	4	4	4	1	1	4

TABLE 6.—*Suitability of the soils for elements of wildlife habitat and for kinds of wildlife*—Continued

Soil series and map symbols	Elements of wildlife habitat								Kinds of wildlife		
	Grain and seed crops	Grasses and legumes	Wild herbaceous upland plants	Hardwood woody plants	Coniferous woody plants	Wetland food and cover plants	Shallow-water developments	Excavated ponds	Openland wildlife	Woodland wildlife	Wetland wildlife
Rock land, Edneyville material:											
Rk	4	4	3	4	4	4	4	4	4	4	4
Rough broken land, shale:											
RlF	4	4	4	4	4	4	4	4	4	4	4
Rowland:											
Ro	4	3	3	1	3	3	3	4	3	2	3
Steep stony land, Parker material:											
SpF	4	3	3	3	1	4	4	4	3	3	4
Turbotville:											
TuB	2	2	1	1	3	3	4	4	2	2	4
Washington:											
WaB, WaC2	2	1	1	1	3	4	4	4	1	1	4
Watchung:											
Wc	3	2	2	1	2	1	1	1	2	2	1

Engineering Uses of the Soils [3]

This section is useful to those who need information about soils used as structural material or as foundation upon which structures are built. Some of those who can benefit from this section are planning commissions, town and city managers, land developers, engineers, contractors, and farmers.

Among properties of soils highly important in engineering are permeability, strength, compaction characteristics, drainage, shrink-swell potential, grain-size distribution, plasticity, and reaction. Also important are slope and depth to the water table and to bedrock. These properties, in various degrees and combinations, affect construction and maintenance of roads, airports, pipelines, foundations for small buildings, irrigations systems, ponds and small dams, and systems for disposal of sewage and refuse.

Information in this section of the soil survey can be helpful to those who—

1. Select potential residential, industrial, commercial and recreational areas.
2. Evaluate alternate routes for roads, highways, pipelines, and underground cables.
3. Seek sources of gravel, sand, or clay.
4. Plan farm drainage systems, irrigation systems, ponds, terraces, and other structures for controlling water and conserving soil.
5. Correlate performance of structures already built with properties of the kinds of soil on which they are built, for the purpose of predicting performance of structures on the same or similar kinds of soil in other locations.
6. Predict the trafficability of soils for cross-country movement of vehicles and construction equipment.
7. Develop preliminary estimates pertinent to construction in a particular area.

Most of the information in this section is presented in tables 7, 8, and 9, which show, respectively, engineering test data, estimates of soil properties significant in engineering, and interpretations for various engineering uses. This information, along with the soil map and other parts of this publication, can be used to make interpretations in addition to those given in table 9. It also can be used to make other useful maps.

Engineering classification systems

The two systems most commonly used in classifying samples of soils for engineering are the Unified system (*14*) used by the SCS engineers, Department of Defense, and others, and the AASHO system (*1*) adopted by the American Association of State Highway Officials.

In the Unified system soils are classified according to particle-size distribution, plasticity, liquid limit, and organic matter. Soils are grouped in 15 classes. There are eight classes of coarse-grained soils, identified as GW, GP, GM, GC, SW, SP, SM, and SC; six classes of fine-grained soils, identified as ML, CL, OL, MH, CH, and OH; and one class of highly organic soils, identified as Pt. Soils on the borderline between two classes are designated by symbols for both classes; for example, ML–CL.

The AASHO system is used to classify soils according to those properties that affect use in highway construction and maintenance. In this system, a soil is placed in one of seven basic groups ranging from A–1 through A–7 on the basis of grain-size distribution, liquid limit, and plasticity index. In group A–1 are gravelly soils of high bearing strength, or the best soils for subgrade (foundation). At the other extreme, in group A–7, are clay soils that have low strength when wet and that are the poorest soils for subgrade. Where laboratory data are available to justify a

[3] KENNETH E. WERKMAN, State conservation engineer, Soil Conservation Service, assisted in the preparation of this section.

further breakdown, the A–1, A–2, and A–7 groups are divided as follows: A–1–a, A–1–b, A–2–4, A–2–5, A–2–6, A–2–7, A–7–5, and A–7–6. As additional refinement, the engineering value of a soil material can be indicated by a group index number. Group indexes, when included, range from 0 for the best material to 20 or more for the poorest. The AASHO classification for tested soils is shown in table 7; the estimated classification for all soils mapped in the survey area is given in table 8.

Engineering test data

All engineering soil test data in this survey are based on sampling and testing by Rutgers University, College of Engineering (*6*, *7*). The tests were performed in accordance with standard procedures of the American Association of State Highway Officials.

The results of the tests are given in table 7. Also in table 7, soil materials are classified according to the Unified and AASHO systems and the textural classification of the U.S. Department of Agriculture. Some of the soil names used in the original engineering study were changed to conform with the current soil classification system.

Test data in table 7 are used as a basis for the estimated range of properties for all series shown in table 8. Soil descriptions of untested soils and test data from adjacent counties were used to extend these estimates for the untested soils in the county.

TABLE 7.—*Engineering*

[Tests performed by the College of Engineering, Rutgers University, in accordance with standard procedures of the

Soil	Sampling site			Depth	Cumulative percentage passing sieve—	
	Site number	Latitude	Longitude		¾ inch	No. 4 (4.7 mm.)
				In.		
Chalfont silt loam	22	74°56′35″	40°30′34″	0–18	100	88
(Shale content higher than in modal profile)				18–40	100	88
				40–66	100	88
Croton silt loam	21	74°58′21″	40°29′49″	0–10	100	100
(Modal profile)				10–32	100	98
Duffield silt loam	45	74°52′55″	40°37′31″	0–10		
(Modal profile)				10–40	98	97
Edneyville gravelly loam	17	74°50′44″	40°41′37″	0–12	97	87
(Gravel content slightly higher in C horizon than in modal profile)				12–30	89	77
				30–42	50	44
Klinesville shaly loam	42	74°54′43″	40°24′53″	0–8		
(Modal profile)				8–14	97	79
				14–20	74	52
Neshaminy gravelly loam	14	74°50′53″	40°34′46″	0–10	90	82
(Modal profile)				10–38	91	87
				38–60	97	83
Norton loam	7	74°44′26″	40°35′10″	0–14		
(Modal profile)				14–30	100	100
				30–42	100	100
Pattenburg gravelly loam	29	75°01′30″	40°37′15″	0–12	88	73
(Modal profile)				12–26	79	64
				26–42	69	56
Penn shaly silt loam	16	74°48′15″	40°26′32″	0–7	94	91
(Shale content lower in A horizon than in modal profile)				7–24	55	51
				24–48	61	59
Penn shaly silt loam	34	74°47′20″	40°33′23″	0–14	97	85
(Coarser textured than in modal profile)				14–22	95	74
				22–30	84	53

[1] SCS and BPR have agreed that any soil having a plasticity index within two points of the A-line is to be given a borderline classification. ML–CL is an example.

Soil properties significant in engineering

Table 8 gives, by series, estimates of some of the soil properties significant in engineering. The information in this table is based on the test data in table 7 and other available data.

Depth to bedrock in table 8 is the distance between the surface of the soil and the upper surface of the rock layer. *Depth to seasonal high water level* is the distance between the surface and the highest level reached in most years by ground water or water perched over a fragipan.

Soil textures in table 8 are given in the standard terms used by the Department of Agriculture. These terms take into account relative percentages of sand, silt, and clay in soil material in which particles are less than 2 millimeters in diameter. Loam, for example, is soil material that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the soil contains gravel or other particles coarser than sand, an appropriate modifier is added, as for example, *gravelly loamy sand.* Sand, clay, and some of the other terms used in USDA textural classification are defined in the Glossary of this soil survey.

Rates for permeability (table 8) are estimated for the soil in place. The estimates were based on structure and porosity, and they were compared with the results of permeability tests on undisturbed cores of similar soil material.

test data

American Association of State Highway Officials (AASHO). Absence of data indicates no determination was made]

Cumulative percentage passing sieve—Con.			Liquid limit	Plasticity index	Maximum density	Optimum moisture content	Classification		
							AASHO		
No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)					Group	Group index	Unified [1]
			Pct.	*Pct.*	*Lbs./cu. ft.*	*Pct.*			
80	75	70	32	8			A–4	7	ML–CL
79	76	69	31	9	105	19	A–4	7	ML–CL
72	68	62	27	8	109	18	A–4	5	CL
98	94	90	27	6			A–4	8	ML–CL
85	82	76	28	9	108	18	A–4	8	CL
90	84	78	32	9	105	18	A–4	8	ML–CL
79	60	46	29	5			A–4	2	SM–SC
61	50	43	33	12	115	14	A–6	2	SM–SC
40	34	26	27	6	114	15	A–2, A–4	0	GM–GC
61	40	33	43	12	100	22	A–2, A–7	2	SM
40	29	25	40	9	105	20	A–2, A–4	0	GM
79	71	64	35	9			A–4	6	ML–CL
87	77	65	29	6	109	18	A–4	6	ML–CL
68	43	25	34	5	101	21	A–1–b	0	SM
100	99	94	36	11			A–6	8	ML–CL
90	78	65	30	9			A–4	6	ML–CL
66	44	20	24	5			A–1–b	0	SM–SC
59	50	35	28	8	117	14	A–2, A–4	0	GM–GC
50	41	29	27	7	117	14	A–2, A–4	0	GM–GC
88	85	80	28	8			A–4	8	ML–CL
50	46	41	36	11	103	19	A–6	1	GM–GC
57	53	46	31	11	105	20	A–6	2	GC
74	52	46	24	6			A–4	2	SM–SC
57	43	38	26	6	110	16	A–4	1	SM–SC
43	29	25	26	7	111	16	A–2, A–4	0	GM–GC

TABLE 8.—*Estimated soil properties*

[An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or more kinds of soil. The soils to other series that appear in the first column of this table.

Soil series and map symbol	Depth to—		Depth from surface (representative profile)	Classification			Coarse fraction greater than 3 inches
	Bedrock	Seasonal high-water level		USDA texture	Unified	AASHO	
	Feet	*Feet*	*Inches*				*Percent*
Abbottstown: AbA, AbB	3½–5+	½–1½	0–16	Silt loam	ML, CL	A–4	0–2
			16–42	Shaly silt loam, silt loam, shaly silty clay loam, silty clay loam (fragipan).	ML, CL, SM, SC	A–4, A–6	0–5
			42	Weathered shale bedrock.			
Alluvial land, loamy: Ac Properties variable.	4+	1–3					
Alluvial land, loamy, wet: Ae Properties variable.	6+	0–1					
*Annandale: AnB, AnC2, ApB, ApC. For Edneyville part of ApB and ApC, see Edneyville series.	6–10+	5+	0–9	Loam, gravelly loam	ML, CL, SM, SC	A–4	0–10
			9–35	Gravelly loam, loam, gravelly clay loam, clay loam.	ML, CL, SM, SC	A–4, A–6	0–10
			35–43	Gravelly loam, loam, gravelly clay loam, clay loam, gravelly sandy loam, sandy loam (fragipan).	ML, CL, SM, SC	A–4, A–6	0–5
			43–60	Gravelly loam, loam, gravelly sandy loam, sandy loam.	ML, CL, SM, SC	A–4	0–10
Athol: AtB, AtC2, AtD2	4–7+	5+	0–10	Loam, gravelly loam	ML	A–4	0–5
			10–49	Gravelly loam, loam, gravelly clay loam, clay loam.	ML, CL	A–4, A–6	0–5
			49–75	Gravelly sandy loam, gravelly loam, loam, sandy loam.	ML, CL, SM, SC, GM	A–2, A–4	0–10
			75	Shale bedrock.			
Bedington: BaB, BaC2	4–5½+	5+	0–14	Shaly silt loam	ML, CL	A–4, A–6	0–10
			14–50	Shaly silt loam or shaly loam	ML, CL, SM, SC, GM	A–4, A–6, A–7	0–10
			50–60	Very shaly loam, shaly loam	GM, ML	A–2, A–4, A–6	0–25
			60	Shale bedrock.			
Berks: BbB, BbC2, BbD2	1½–3½	3+	0–12	Shale loam, loam	SM, SC, GM, GC	A–2, A–4	0–20
			12–26	Very shaly loam, shaly loam, loam.	GM, GC, SM, SC	A–1, A–2, A–4	0–30
			26	Shale bedrock.			
Birdsboro: BdA, BdB, BdC2.	5–10+	3+	0–13	Silt loam, loam	ML, CL	A–4, A–6	0–5
			13–40	Silt loam, loam, clay loam, silty clay loam.	ML, CL	A–4, A–6	0–5
			40–60	Stratified silt loam, silty clay loam, sand, gravel.	ML, CL, SM, SC, GM	A–2, A–4	0–10
Bowmansville: Bt	3½–10+	0–1	0–60	Silt loam, loam	ML, CL	A–4, A–6	0–5
Bucks: BuB, BuC2	3½–5+	5+	0–12	Silt loam	ML, CL	A–4	----
			12–32	Silt loam, shaly loam	ML, CL	A–4	----
			32–44	Shaly loam, very shaly loam	ML, CL, GM, SM, SC, GC	A–2, A–4	5–15
			44	Shale.			

See footnotes at end of table.

significant to engineering

in such mapping units may have different properties, and for this reason it is necessary to follow carefully the instructions for referring Symbol < means less than; symbol > means more than]

Percentage passing sieve—				Permeability	Available water capacity	Liquid limit	Plasticity index	Optimum moisture content for compaction	Maximum dry density	Reaction (unlimed)	Shrink-swell potential
No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)								
				Inches per hour	*Inches per inch of soil*			*Percent of dry weight*	*Pounds per cubic foot*	*pH*	
90–100	85–95	75–95	60–85	0. 63–2. 0	0. 20–0. 26	20–30	5–10	15–25	100–115	4. 5–5. 5	Low.
80–100	70–90	50–90	40–85	<0. 2	0. 08–0. 12	20–30	0–10	15–25	100–115	4. 5–6. 0	Low.
90–100	85–95	75–90	40–60	0. 63–2. 0	0. 18–0. 22	20–30	6–10	15–20	100–110	4. 5–6. 0	Low.
90–100	80–90	50–80	40–70	0. 63–2. 0	0. 14–0. 18	25–35	5–12	15–20	100–110	4. 5–6. 0	Low or moderate.
80–95	65–90	60–70	40–60	<0. 2–0. 63	0. 10–0. 14	20–30	5–12	15–20	100–110	4. 5–6. 0	Low or moderate.
70–100	65–95	60–90	45–70	0. 2–2. 0	0. 12–0. 18	15–25	5–10	15–20	100–110	4. 5–6. 0	Low.
90–100	85–95	80–90	50–70	0. 63–2. 0	0. 18–0. 24	30–40	4–10	15–20	100–110	6. 1–7. 0	Low.
90–100	80–90	75–90	65–80	0. 63–2. 0	0. 18–0. 24	30–40	8–12	15–20	95–110	5. 6–6. 0	Moderate.
70–100	60–90	50–80	30–60	0. 63–6. 3	0. 14–0. 18	25–35	6–10	13–18	100–110	5. 6–6. 5	Low.
75–100	70–95	60–95	50–90	0. 63–2. 0	0. 15–0. 22	20–40	5–12	10–20	100–125	5. 1–5. 5	Low.
75–100	70–100	50–90	40–90	0. 63–2. 0	0. 12–0. 20	25–45	5–14	15–25	90–110	5. 1–5. 5	Moderate.
50–80	40–80	30–70	20–60	2. 0–6. 3	0. 08–0. 15	20–40	3–15	15–25	90–110	4. 5–5. 0	Low.
55–90	50–90	35–65	25–50	2. 0–6. 3	0. 10–0. 18	25–35	5–10	15–20	100–120	5. 1–6. 0	Low.
40–70	30–60	25–55	20–50	2. 0–6. 3	0. 06–0. 12	25–30	4–10	12–18	105–115	4. 5–5. 5	Low.
95–100	90–100	85–100	50–90	0. 63–2. 0	0. 20–0. 26	25–35	5–12	10–20	105–125	4. 5–5. 5	Low.
90–100	85–100	80–100	50–95	0. 63–2. 0	0. 14–0. 20	25–35	5–12	10–20	105–125	4. 5–5. 5	Low or moderate.
70–100	40–100	30–100	10–75	0. 63–>6. 3	0. 06–0. 20	NL–20[1]	NP–10[2]	8–15	110–130	4. 5–5. 5	Low.
95–100	90–100	80–100	65–100	0. 2–2. 0	0. 20–0. 26	20–35	5–15	15–25	100–110	4. 5–5. 5	Low.
95–100	95–100	90–100	60–90	0. 2–2. 0	0. 18–0. 24	25–35	4–10	18–22	100–110	4. 5–5. 0	Low.
90–100	80–100	70–100	60–90	0. 2–2. 0	0. 18–0. 24	25–35	4–10	18–22	100–110	4. 5–5. 0	Moderate.
60–90	20–80	20–80	15–70	0. 2–2. 0	0. 08–0. 16	20–30	2–10	14–18	100–110	4. 5–5. 0	Low.

TABLE 8.—*Estimated soil properties*

Soil series and map symbol	Depth to—		Depth from surface (representative profile)	Classification			Coarse fraction greater than 3 inches
	Bedrock	Seasonal high-water level		USDA texture	Unified	AASHO	
	Feet	*Feet*	*Inches*				*Percent*
Califon: CaA, CaB, CbB	6–10+	½–2½	0–10	Loam, gravelly loam	ML, CL	A–4, A–6	0–10
			10–23	Gravelly loam, loam, gravelly clay loam, clay loam.	ML, CL, SM, SC	A–4, A–6	0–10
			23–50	Gravelly loam, loam, gravelly clay loam, clay loam, gravelly silty clay loam, silty clay loam (fragipan).	ML, CL, SM, SC	A–4, A–6	0–1
			50–60	Sandy loam, loam	SC, ML, CL	A–4	0–10
*Chalfont: CdA, CdB, CdC2, CeB, CfC, CgB. For Lehigh part of CfC, see Lehigh series. For Quakertown part of CgB, see Quakertown series.	3½–6+	½–1½	0–9	Silty loam, very stony silt loam	ML, CL	A–4	0–5
			9–26	Silt loam, silty clay loam	ML, CL	A–4	0–5
			26–42	Shaly silty clay loam, silty clay loam (fragipan).	ML, CL	A–4, A–6	0–5
			42–50	Very channery silt loam	GM, GC, ML, CL, SM, SC	A–4	0–10
			50	Argillite bedrock.			
Cokesbury: Co, Cp	6–10+	0–1	0–9	Loam, gravelly loam, very stony loam.	ML, CL	A–4, A–6	0–10
			9–28	Gravelly sandy loam, sandy loam, gravelly sandy clay loam, sandy clay loam, gravelly clay loam, clay loam.	ML, CL	A–4, A–6	0–10
			28–40	Gravelly loam, loam, gravelly clay loam, clay loam (fragipan).	ML, CL, SM, SC	A–4, A–6	0–10
			40–60	Gravelly loam, gravelly sandy loam.	ML, CL, SM, SC, GM, GC	A–4	5–10
Croton: CrA, CrB, CsB	3½–5+	0–1	0–9	Silty loam, very stony silt loam	ML, CL	A–4, A–6	0–5
			9–18	Silt loam, silty clay loam	ML, CL	A–4, A–6, A–7	0–10
			18–48	Shaly silty clay loam, silty clay loam, shaly silt loam, silt loam (fragipan).	ML, CL	A–4, A–6	0–20
			48	Shattered shale bedrock.			
Duffield: DuB, DuC2, DvC2, DwD2.	4–7	4+	0–9	Silt loam	ML, CL	A–4, A–6	-------
			9–42	Silt loam, silty clay loam	ML, CL	A–4, A–6, A–7	0–10
			42–56	Loam, shaly loam	ML, CL	A–4, A–5, A–6, A–7	-------
			56	Limestone bedrock.			
*Edneyville: EdB, EdC2, EdD, EeC. For Parker part of EeC, see Parker series.	3½–6+	4–8+	0–13	Gravelly loam, extremely stony loam.	SM, SC, ML, CL, GM	A–2, A–4	0–15
			13–28	Gravelly sandy loam, clay loam, sandy clay loam, loam.	SM, SC, ML, CL	A–4, A–6	0–15
			28–42	Gravelly sandy loam, clay loam, sandy clay loam, loam.	SM, GM, GC, ML	A–2, A–4	0–15
			42	Gneiss bedrock.			
Hazleton: HaB, HaC2, HaD, HcC, HcE.	4–5+	4+	0–9	Channery loam, very stony loam	SM, SC, GM, GC	A–2, A–4	0–10
			9–40	Channery loam	GM, GC SM, SC	A–2, A–4	0–20
			40–50	Very channery loam	GM, GC	A–2, A–4	0–30
			50	Sandstone.			

See footnotes at end of table.

significant to engineering—Continued

Percentage passing sieve—				Permeability	Available water capacity	Liquid limit	Plasticity index	Optimum moisture content for compaction	Maximum dry density	Reaction (unlimed)	Shrink-swell potential
No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)								
				Inches per hour	*Inches per inch of soil*			*Percent of dry weight*	*Pounds per cubic foot*	*pH*	
80–100	75–95	70–80	50–70	0. 63–2. 0	0. 18–0. 25	20–30	8–12	15–20	100–110	4. 5–5. 5	Low.
85–100	80–95	65–80	45–70	0. 63–2. 0	0. 16–0. 22	25–35	5–12	15–20	100–110	4. 5–5. 5	Moderate.
85–100	80–95	60–80	40–70	<0. 2	0. 06–0. 10	20–30	5–12	15–20	100–110	4. 5–5. 5	Low.
85–95	80–95	60–90	40–60	0. 63–2. 0	0. 14–0. 18	15–25	5–10	15–20	100–120	4. 5–5. 5	Low.
90–100	90–100	75–100	70–95	0. 2–2. 0	0. 20–0. 26	25–35	NP–10	12–20	105–115	4. 5–5. 5	Low.
90–100	90–100	70–100	70–90	0. 2–2. 0	0. 18–0. 24	25–35	NP–10	12–20	105–115	4. 5–5. 5	Low.
80–100	80–100	80–100	70–90	<0. 2	0. 08–0. 12	25–40	NP–15	12–20	105–115	4. 5–5. 5	Low.
70–100	50–80	50–80	40–80	0. 2–2. 0	0. 08–0. 12	25–35	NP–10	12–20	105–115	4. 5–5. 5	Low.
90–100	75–95	65–85	50–80	0. 63–2. 0	0. 20–0. 25	30–40	8–12	15–20	100–110	5. 1–5. 5	Low.
80–100	80–95	70–80	50–70	0. 2–0. 63	0. 16–0. 20	25–35	5–12	15–20	100–110	5. 1–5. 5	Moderate.
80–85	65–85	60–75	40–60	<0. 2	0. 08–0. 12	20–35	5–12	15–20	100–110	4. 5–5. 5	Low.
70–95	50–70	50–65	40–60	0. 63–2. 0	0. 14–0. 18	15–25	5–10	15–20	100–110	4. 5–5. 5	Low.
90–100	90–100	70–100	75–90	0. 2–2. 0	0. 20–0. 26	20–40	5–15	10–16	110–125	4. 5–5. 5	Low.
90–100	85–100	75–100	70–90	0. 2–0. 63	0. 20–0. 26	30–50	5–25	14–20	100–115	4. 5–6. 0	Moderate.
80–100	65–100	65–100	60–90	<0. 2	0. 06–0. 10	20–40	5–20	10–16	110–125	4. 5–6. 0	Moderate.
95–100	95–100	90–100	70–95	0. 63–2. 0	0. 20–0. 24	30–40	8–12	10–20	105–125	5. 1–6. 0	Low.
90–100	85–100	80–100	70–95	0. 63–2. 0	0. 18–0. 22	30–45	8–15	10–20	105–115	5. 1–5. 5	Moderate.
80–100	75–100	75–95	60–95	0. 63–2. 0	0. 16–0. 20	30–45	5–15	10–20	105–115	5. 1–5. 5	Moderate.
70–90	60–85	45–65	30–60	0. 63–2. 0	0. 16–0. 20	25–40	5–10	10–15	110–120	5. 1–5. 5	Low.
75–90	55–75	45–65	35–65	0. 63–2. 0	0. 12–0. 16	25–35	5–15	10–15	110–120	5. 1–5. 5	Low.
50–100	50–90	40–80	25–60	2. 0–6. 3	0. 12–0. 16	20–35	NP–8	15–20	105–115	4. 5–5. 0	Low.
60–100	50–80	45–60	25–50	2. 0–6. 3	0. 08–0. 12	20–30	4–8	10–15	110–120	4. 0–5. 5	Low.
50–90	50–70	30–60	15–45	2. 0–6. 3	0. 04–0. 12	15–25	4–8	10–15	110–120	4. 0–5. 5	Low.
40–60	30–50	25–50	20–40	2. 0–>6. 3	0. 04–0. 10	15–25	4–8	10–15	110–120	4. 0–5. 5	Low.

TABLE 8.—*Estimated soil properties*

Soil series and map symbol	Depth to—		Depth from surface (representative profile)	Classification			Coarse fraction greater than 3 inches
	Bedrock	Seasonal high-water level		USDA texture	Unified	AASHO	
	Feet	*Feet*	*Inches*				*Percent*
Klinesville: KIC, KID	1–1½	3–5+	0–7	Shaly loam	SM, SC, GM	A–2, A–4	0–10
			7–18	Very shaly loam	GM, GP	A–1, A–2	10–30
			18	Shale bedrock.			
Lansdale: LaB, LaC2, LaD	3½–5+	5+	0–14	Loam	SM, ML, CL	A–4	0–5
			14–40	Gravelly loam, loam, gravelly clay loam, clay loam, gravelly sandy loam, sandy loam, gravelly sandy clay loam, sandy clay loam.	SM, SC, ML, CL	A–2, A–4, A–6	0–10
			40–60	Fine sandy loam, channery sandy loam.	SM, SC, GM, GC	A–2, A–4	0–20
			60	Sandstone bedrock.			
Lansdowne: LbB	3½–5+	1–2½	0–13	Silt loam	ML, CL	A–4, A–6, A–7	0–5
			13–45	Silty clay, silty clay loam, clay loam.	ML, CL	A–6, A–7	0–5
			45–60	Shaly silty clay	ML, CL, SM, SC	A–4, A–6	5–10
			60	Shale bedrock.			
Lawrenceville: LeB, LeC2	3½–7+	1½–3	0–8	Silt loam	ML, CL	A–4, A–6	0
			8–28	Silt loam, silty clay loam	ML, CL	A–4, A–6	0
			28–40	Silt loam (fragipan)	ML, CL	A–4, A–6	0
			40–55	Shaly silt loam	ML, CL, SM	A–4, A–6	0
			55	Shale bedrock.			
Legore: LgB, LgC, LgD	5–8+	4+	0–9	Gravelly loam	ML, CL, SM, SC, GM, GC	A–4	0–15
			9–22	Gravelly loam, loam, gravelly clay loam, clay loam.	ML, CL, SM, SC, GM, GC	A–4	0–15
			22–50	Gravelly loam	SM, SC, GM, GC	A–2, A–4	0–15
			50	Diabase bedrock.			
Lehigh: LhB, LhC2, LhD2, LkB, LkC.	3½–5+	½–2	0–9	Silt loam (very stony)	ML, CL	A–2, A–4	0–10
			9–30	Shaly silt loam, silt loam, shaly silty clay loam, silty clay loam.	ML, CL, GC	A–4, A–6	0–10
			30–42	Shaly or very shaly silt loam	ML, CL, GM, GC	A–2, A–4, A–6	0–20
			42	Shale bedrock.			
Made land: Ma. Too variable to estimate.							
Meckesville: MeB, MeC2	5–8+	5+	0–10	Gravelly loam	ML, CL	A–4	0–3
			10–31	Gravelly loam, loam, gravelly silt loam, silt loam, gravelly clay loam, clay loam, gravelly silty clay loam, silty clay loam.	ML, CL, SC, SM	A–4	0–3
			31–38	Gravelly loam, loam, gravelly silt loam, silt loam, gravelly clay loam, clay loam, gravelly silty clay loam, silty clay loam (fragipan).	ML, CL, SC, SM	A–4	0–3
			38–60	Gravelly loam, loam, gravelly clay loam, clay loam.	ML, CL, SC, SM	A–4	0–5
			60	Sandstone bedrock.			

See footnotes at end of table.

significant to engineering—Continued

Percentage passing sieve—				Permeability	Available water capacity	Liquid limit	Plasticity index	Optimum moisture-content for compaction	Maximum dry density	Reaction (unlimed)	Shrink-swell potential
No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)								
				Inches per hour	*Inches per inch of soil*			*Percent of dry weight*	*Pounds per cubic foot*	*pH*	
50–80	50–70	20–60	12–35	2. 0–6. 3	0. 08–0. 18	25–40	3–15	10–20	100–125	4. 5–5. 5	Low.
30–70	30–60	10–40	5–30	2. 0–6. 3	0. 08–0. 12	20–40	NP–10	8–20	105–125	4. 5–5. 5	Low.
80–100	80–100	70–90	40–70	0. 63–2. 0	0. 12–0. 22	20–30	5–10	10–15	110–120	4. 5–5. 0	Low.
60–100	60–90	40–80	30–75	0. 63–2. 0	0. 12–0. 20	25–35	5–10	10–15	110–120	4. 5–5. 0	Low.
60–90	60–80	40–70	15–40	2. 0–6. 3	0. 10–0. 14	20–30	2–8	10–15	110–125	4. 5–5. 0	Low.
95–100	90–100	85–90	65–90	0. 63–2. 0	0. 22–0. 26	30–50	15–20	18–22	95–105	5. 1–5. 5	Low.
95–100	95–100	90–100	70–95	<0. 2	0. 16–0. 20	30–50	20–30	20–25	95–105	5. 1–5. 5	Moderate.
70–95	70–80	65–75	40–60	0. 63–2. 0	0. 14–0. 18	30–40	15–20	15–20	100–110	5. 1–5. 5	Low.
95–100	95–100	95–100	90–100	0. 63–2. 0	0. 20–0. 24	30–40	NP–12	15–20	100–110	4. 5–5. 5	Low.
95–100	95–100	95–100	80–100	0. 63–2. 0	0. 18–0. 22	30–40	8–12	15–20	100–110	4. 5–5. 5	Low.
95–100	95–100	95–100	95–100	0. 2–0. 63	0. 10–0. 18	30–40	8–12	15–20	100–110	4. 5–6. 5	Low.
90–100	80–100	80–100	45–90	0. 2–2. 0	0. 14–0. 20	25–40	NP–12	15–25	95–110	4. 5–6. 5	Low.
70–100	65–95	50–95	40–70	0. 63–6. 3	0. 14–0. 18	25–40	5–10	10–20	105–125	5. 1–6. 0	Low.
70–100	65–95	50–95	40–70	0. 63–2. 0	0. 12–0. 16	25–35	5–10	15–25	90–110	5. 6–6. 5	Low to moderate.
65–100	65–95	40–85	15–50	2. 0–6. 3	0. 10–0. 16	10–30	NP–10	10–20	105–125	5. 6–6. 5	Low.
75–100	65–95	40–80	40–75	0. 2–2. 0	0. 16–0. 26	25–35	5–10	15–20	100–110	4. 5–5. 0	Low.
75–95	65–95	40–70	40–70	<0. 2–0. 63	0. 14–0. 22	30–40	5–15	15–20	100–110	4. 5–5. 5	Low to moderate.
50–75	40–65	30–60	30–55	0. 2–0. 63	0. 10–0. 16	25–40	5–12	10–20	105–125	4. 5–5. 5	Low.
90–100	80–100	70–90	55–75	0. 63–2. 0	0. 18–0. 22	20–30	3–10	15–20	100–110	4. 5–5. 0	Low.
90–100	80–95	70–90	45–85	0. 63–2. 0	0. 14–0. 18	25–35	3–10	15–20	100–110	4. 5–5. 5	Moderate.
90–100	80–95	75–90	40–85	<0. 2	0. 10–0. 14	20–30	3–10	15–20	100–110	4. 5–5. 5	Low.
90–100	80–90	65–85	40–60	0. 63–2. 0	0. 10–0. 14	20–30	3–10	15–20	100–110	4. 5–5. 5	Low.

TABLE 8.—*Estimated soil properties*

Soil series and map symbol	Depth to—		Depth from surface (representative profile)	Classification			Coarse fraction greater than 3 inches
	Bedrock	Seasonal high-water level		USDA texture	Unified	AASHO	
	Feet	*Feet*	*Inches*				*Percent*
*Mount Lucas: MoB, MwB—For Watchung part of MwB, see Watchung series.	4–8+	½–2½	0–12	Silt loam, very stony silt loam	ML, CL	A–4, A–7, A–6.	0–15
			12–40	Gravelly silt loam, silt loam, gravelly silty clay loam, silty clay loam.	ML, CL	A–4, A–6, A–7.	0–10
			40–60	Gravelly silt loam, silt loam, gravelly loam, loam, gravelly sandy loam, sandy loam.	SM, SC, ML	A–2, A–4	0–5
*Neshaminy: NdB, NeB, NeC2, NhC, NhD, NhE, NkC—For Mount Lucas part of NkC, see Mount Lucas series.	4–8+	5+	0–11	Silt loam, gravelly loam, very stony silt loam.	ML, CL	A–4, A–6	0–10
			11–42	Gravelly silty clay loam, silty clay loam, gravelly silt loam, silt loam.	ML, CL	A–4, A–6, A–7.	0–15
			42–60	Gravelly loam, gravelly sandy loam.	SM, SC, GM, GC, ML, CL	A–1, A–2, A–4, A–6.	0–15
			60	Diabase or basalt bedrock.			
Norton: NoB, NoC2, NoD2	4–10+	5+	0–13	Loam	ML, CL	A–4, A–6	--------
			13–76	Silt loam, silty clay loam, clay loam.	ML, CL	A–4, A–6, A–7	--------
			76–83	Shaly loam, loam, shaly clay loam, clay loam, shaly silty clay loam, silty clay loam.	ML, CL, SM, SC	A–4, A–6	0–10
			83	Shale bedrock.			
Parker: PaC, PaD	3½–8+	5+	0–9	Cobbly loam	SM, GM, GC	A–1, A–2	5–10
			9–22	Cobbly sandy loam, cobbly loam	GM, GP, GC	A–2, A–1	5–10
			22–41	Very cobbly sandy loam	GM	A–2, A–1	5–15
			41	Gneiss bedrock.			
Pattenburg: PbB, PbC2, PbD, PbE, PcB—Seasonal high water table is at a depth of 1½ to 2½ feet in PcB.	1½–8+	5+	0–7	Gravelly loam	SM, SC	A–4, A–2, A–1	0–5
			7–30	Gravelly loam, gravelly silt loam, gravelly clay loam.	GM, GC, SM, SC	A–1, A–2, A–4	0–5
			30–60	Gravelly or very gravelly loam, gravelly or very gravelly sandy loam.	GM, SM, GC, SC	A–1, A–2, A–4	0–5
			60	Sandy shale conglomerate.			
*Penn: PeB, PeC2, PeD, PfB, PfC2—For Bucks part of PfB and PfC2, see Bucks series.	1½–3½	4+	0–9	Shaly silt loam	ML, CL	A–4	0–20
			9–22	Shaly silt loam, shaly loam	ML, CL, SM, SC, GM, GC	A–4, A–6, A–2	0–10
			22–30	Very shaly loam	GM, GC	A–2, A–4	0–20
			30	Shale bedrock.			
Pope: Pk	6+	5+	0–12	Fine sandy loam	SM	A–2, A–4	0
			12–46	Sandy loam, fine sandy loam, loam.	SM, SC	A–2, A–4	0
			46–60	Gravelly or very gravelly sandy loam, sandy loam, gravelly or very gravelly loamy sand, loamy sand.	SM, SP–SM	A–1, A–2, A–3	0–2
*Quakertown: QkA, QkB, QkC2, QkD2, QlC2—For Chalfont part of QlC2, see Chalfont series.	3½–6+	5+	0–12	Silt loam	ML, CL	A–4, A–6	0–5
			12–36	Channery silt loam, silt loam, channery silty clay loam, silty clay loam.	ML, CL	A–4, A–6	0–10
			36–56	Channery or very channery clay loam, clay loam, channery or very channery loam, loam.	ML, CL, SM, SC, GM, GC	A–2, A–4, A–6	5–15

See footnotes at end of table.

significant to engineering—Continued

Percentage passing sieve—				Permeability	Available water capacity	Liquid limit	Plasticity index	Optimum moisture content for compaction	Maximum dry density	Reaction (unlimed)	Shrink-swell potential
No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)								
				Inches per hour	*Inches per inch of soil*			*Percent of dry weight*	*Pounds per cubic foot*	*pH*	
90–100	80–100	80–100	60–85	0. 2–2. 0	0. 16–0. 25	25–45	8–15	10–20	105–125	5. 6–6. 0	Low.
95–100	80–100	75–100	55–80	0. 2–2. 0	0. 16–0. 22	30–50	5–20	15–25	90–110	5. 6–6. 0	Low to moderate.
90–100	80–100	60–90	30–55	0. 63–2. 0	0. 10–0. 18	25–40	NP–10	10–20	105–125	5. 6–6. 0	Low.
90–100	80–100	70–100	55–90	0. 63–2. 0	0. 14–0. 24	25–40	8–15	15–25	90–110	4. 5–5. 5	Low.
85–100	80–100	70–100	50–85	0. 2–2. 0	0. 14–0. 20	30–50	5–20	15–25	90–110	4. 5–6. 0	Low to moderate.
70–80	50–70	40–60	25–60	0. 63–2. 0	0. 10–0. 20	25–40	5–15	10–20	100–125	4. 5–6. 0	Low.
95–100	90–100	75–90	60–75	0. 2–2. 0	0. 18–0. 22	25–35	8–12	15–20	100–110	4. 0–5. 5	Low.
95–100	90–100	85–100	60–95	<0. 2	0. 12–0. 18	30–45	10–15	18–22	100–110	4. 5–5. 5	Moderate.
90–100	80–100	50–70	40–65	0. 2–2. 0	0. 10–0. 14	25–40	8–12	15–20	100–110	4. 5–5. 5	Low.
50–70	40–65	20–50	15–35	2. 0–6. 3	0. 06–0. 10	15–25	3–10	10–15	110–125	4. 5–5. 5	Low.
50–65	40–65	20–55	15–35	2. 0–6. 3	0. 06–0. 10	15–25	5–10	10–15	110–125	4. 5–5. 5	Low.
50–65	30–40	15–30	15–35	>6. 3	0. 04–0. 08	15–25	3–10	10–15	110–125	4. 5–5. 5	Low.
70–95	60–90	45–80	20–50	2. 0–6. 3	0. 14–0. 18	20–30	2–6	10–15	110–125	4. 5–5. 0	Low.
65–90	60–75	50–75	35–45	0. 63–2. 0	0. 12–0. 20	25–35	5–10	10–15	110–125	4. 5–5. 0	Low.
50–70	25–65	20–55	15–50	2. 0–6. 3	0. 05–0. 15	20–30	5–10	10–15	110–125	4. 5–5. 0	Low.
75–90	70–90	55–85	50–80	0. 63–6. 3	0. 14–0. 20	20–35	5–10	12–18	105–115	4. 5–5. 5	Low.
50–90	50–80	40–80	40–80	2. 0–6. 3	0. 12–0. 18	25–35	4–12	12–18	110–120	4. 5–5. 5	Low.
40–60	30–60	20–55	15–50	2. 0–6. 3	0. 06–0. 12	20–30	2–12	10–16	110–125	4. 5–5. 5	Low.
95–100	95–100	80–90	30–50	2. 0–6. 3	0. 10–0. 16	15–25	NP–10	10–15	110–125	4. 0–5. 0	Low.
95–100	95–100	80–90	30–50	2. 0–6. 3	0. 10–0. 16	15–25	NP–10	10–15	110–125	4. 5–5. 6	Low.
80–100	20–80	20–80	10–30	>6. 3	0. 05–0. 10	NL–20	NP–10	8–15	115–125	5. 6–6. 0	Low.
95–100	70–95	70–90	60–80	0. 63–2. 0	0. 20–0. 25	30–40	8–12	15–20	100–110	5. 1–6. 0	Low.
80–100	70–95	70–90	60–80	0. 2–0. 63	0. 14–0. 22	25–35	8–12	15–20	100–110	5. 1–6. 0	Low.
50–90	30–80	30–70	20–70	0. 2–2. 0	0. 10–0. 18	25–35	8–12	10–15	110–125	5. 1–6. 0	Low.

TABLE 8.—*Estimated soil properties*

Soil series and map symbol	Depth to—		Depth from surface (representative profile)	Classification			Coarse fraction greater than 3 inches
	Bedrock	Seasonal high-water level		USDA texture	Unified	AASHO	
	Feet	*Feet*	*Inches*				*Percent*
Raritan: RbA, RbB	5–7+	1–2	0–13	Silt loam, loam	ML, CL	A–4	
			13–24	Silt loam, loam, clay loam	ML, CL	A–4, A–6	
			24–44	Clay loam, loam, silt loam (fragipan).	ML, CL	A–4, A–6	
			44–60	Gravelly or very gravelly silt loam, silt loam, gravelly or very gravelly sand, sand.	ML, CL, SM, SC, GM	A–2, A–3, A–4	0–10
Readington: RcB, RcC2	3½–5+	1½–3	0–14	Silt loam	ML, CL	A–4	
			14–26	Silt loam, silty clay loam	ML, CL	A–4, A–6	
			26–46	Shaly silt loam, shaly silty clay loam (fragipan).	ML, CL, GM, GC	A–4, A–6	0–10
			46	Shale bedrock.			
Reaville: ReA, ReB, ReC2	1½–3½	1–2	0–13	Silt loam, shaly silt loam	ML, CL	A–4	0–10
			13–23	Silt loam, shaly silt loam	ML, CL, CH, SM, SC	A–4, A–6, A–7, A–2	0–20
			23	Shale bedrock.			
Reaville, wet variant: RfA, RfB.	1½–2½	0–1	0–8	Silt loam, shaly silt loam	ML, CL	A–4, A–6	0–2
			8–20	Silty clay loam, shaly silty clay loam.	ML, CL, CH	A–4, A–6, A–7	0–5
			20	Shale bedrock.			
Riverhead: RgB, RgC	10+	5+	0–9	Gravelly sandy loam, gravelly fine sandy loam.	SM	A–2	0–2
			9–34	Gravelly sandy loam or fine sandy loam.	SM	A–2	0–2
			34–60	Stratified layers of sand and gravel.	SM, SP-SM	A–1, A–2, A–3.	0–5
Rock land, Edneyville material: Rk. Properties variable. For properties of soil between outcrops, see Edneyville series.							
Rough broken land, shale: RlF. Properties variable.							
Rowland: Ro	4–6+	1–2½	0–60	Silt loam, loam, silty clay loam	ML, CL	A–4, A–6	0–2
			60–80	Stratified layers of sand and gravel.	GM, SM	A–1, A–2, A–4	0–5
Steep stony land, Parker material: SpF. Properties variable. For properties of soil between outcrops, see Parker series.							
Turbotville: TuB	5–8+	½–1½	0–10	Loam	ML, CL	A–4, A–6	0–5
			10–28	Loam, silty clay loam, silt loam, clay loam.	ML, CL	A–4, A–6	0–5
			28–42	Silty clay loam (fragipan)	ML, CL	A–4, A–6	0–5
			42–60	Gravelly loam, loam, gravelly sandy loam, sandy loam.	SM, SC, ML, CL	A–2, A–4	0–10
			60	Limestone bedrock.			

See footnote at end of table.

significant to engineering—Continued

Percentage passing sieve—				Permeability	Available water capacity	Liquid limit	Plasticity index	Optimum moisture content for compaction	Maximum dry density	Reaction (unlimed)	Shrink-swell potential
No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)								
				Inches per hour	*Inches per inch of soil*			*Percent of dry weight*	*Pounds per cubic foot*	*pH*	
95–100	85–95	85–95	80–95	0. 63–6. 3	0. 20–0. 28	20–30	4–8	10–15	110–125	4. 5–5. 5	Low.
95–100	85–95	85–95	70–95	0. 2–0. 63	0. 20–0. 25	25–35	5–12	10–20	105–125	4. 5–5. 5	Low or moderate.
95–100	85–95	85–95	70–95	0. 2–0. 63	0. 08–0. 12	25–35	5–12	10–20	105–125	4. 5–5. 5	Low or moderate.
50–100	30–100	30–100	10–60	0. 63–6. 3	0. 05–0. 20	10–30	5–10	8–20	100–130	4. 5–5. 5	Low.
95–100	85–100	70–100	60–90	0. 63–2. 0	0. 22–0. 26	25–35	5–10	10–20	105–125	4. 5–5. 0	Low.
95–100	85–100	70–100	60–90	0. 2–2. 0	0. 20–0. 24	30–40	10–20	10–20	105–125	4. 5–5. 5	Low or moderate.
70–100	50–70	50–70	40–70	0. 2–2. 0	0. 10–0. 14	20–30	10–20	10–20	105–125	4. 5–6. 0	Low.
90–100	80–95	60–90	55–90	0. 63–2. 0	0. 18–0. 24	20–30	NP–15	15–20	100–115	4. 5–5. 5	Low.
70–100	65–100	40–95	30–90	<2. 0	0. 12–0. 20	20–40	NP–30	15–20	95–115	4. 5–6. 0	Low.
90–100	80–100	70–90	55–75	0. 63–2. 0	0. 18–0. 24	25–35	3–12	15–25	95–110	4. 5–5. 5	Low.
85–100	70–100	65–95	55–90	<0. 2	0. 12–0. 20	30–40	8–35	15–25	90–110	4. 5–5. 5	Moderate.
90–100	75–85	65–80	20–45	2. 0–6. 3	0. 12–0. 16	5–10	2–5	10–15	110–125	5. 1–5. 5	Low.
90–100	70–80	65–70	20–40	2. 0–6. 3	0. 12–0. 18	5–10	2–5	10–15	110–125	5. 1–5. 5	Low.
80–100	60–80	50–70	5–20	>6. 3	0. 05–0. 10	5–10	NP–5	10–15	110–125	4. 5–5. 0	Low.
95–100	95–100	80–90	50–80	0. 2–2. 0	0. 20–0. 26	15–30	NP–12	10–25	100–125	5. 1–5. 5	Low or moderate.
70–100	50–70	40–70	20–30	2. 0–6. 3	0. 05–0. 10	5–10	NP–5	95–110	110–125	5. 1–6. 0	Low.
90–100	85–100	75–95	55–75	0. 63–2. 0	0. 20–0. 26	25–35	8–12	15–20	100–110	5. 1–6. 5	Low.
90–100	85–100	80–95	60–90	0. 2–2. 0	0. 20–0. 24	30–40	8–12	15–20	100–110	5. 6–6. 5	Moderate.
90–100	85–100	80–95	50–85	0. 2–0. 63	0. 10–0. 14	30–40	8–12	15–20	105–115	5. 6–6. 5	Moderate.
90–100	65–100	60–90	30–70	0. 63–2. 0	0. 10–0. 16	15–25	5–10	10–15	110–125	6. 1–7. 3	Low.

TABLE 8.—*Estimated soil properties*

Soil series and map symbol	Depth to—		Depth from surface (representative profile)	Classification			Coarse fraction greater than 3 inches
	Bedrock	Seasonal high-water level		USDA texture	Unified	AASHO	
	Feet	*Feet*	*Inches*				*Percent*
Washington: WaB, WaC2	5–8+	5+	0–9	Loam, gravelly loam	ML, CL	A–4, A–6	0–5
			9–52	Gravelly loam, loam, gravelly clay loam, clay loam, gravelly silt loam, silt loam, gravelly silty clay loam, silty clay loam.	ML, CL	A–4, A–6	0–5
			52–60	Gravelly loam, loam, gravelly silt loam, silt loam.	ML, CL	A–4, A–6	5–10
Watchung: Wc	5–7+	0–1	0–11	Silt loam, silty clay loam, very stony silt loam.	ML, CL	A–4, A–6	0–15
			11–36	Silty clay loam, silty clay	ML, CL, CH	A–6, A–7	0–5
			36–60	Silt loam, gravelly silt loam	ML, CL	A–4, A–6	0–10

[1] NL means nonliquid.

TABLE 9.—*Interpretations of*

[An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or more kinds of soil. The soils for referring to other series that appear

Soil series and map symbol	Suitability as a source of—			Soil features affecting—		
	Topsoil	Sand and gravel	Road fill	Road location	Ponds	
					Reservoir area	Embankment material
Abbottstown: AbA, AbB.	Good: seasonal high water at a depth of ½ to 1½ feet.	Unsuitable: silty material.	Fair: A–4, A–6; shale content of substratum increases with depth.	Seasonal high water at a depth of ½ to 1½ feet; high potential frost action; seepage above fragipan.	Seasonal high water perched at a depth of ½ to 1 foot; pervious bedrock at a depth of 3½ to 5 feet.	Fair stability; fair compaction; piping hazard.
Alluvial land, loamy: Ac.	Good: seasonal high water table at a depth of 1 to 3 feet; flooding hazard.	Unsuitable: loamy material; excessive fines.	Fair: A–4, A–6; seasonal high water table at a depth of 1 to to 3 feet; substratum gravelly and cobbly.	Seasonal high water table at a depth of 1 to 3 feet; flooding hazard.	Seasonal high water table at a depth of 1 to 3 feet; pervious substratum; flooding hazard.	Fair stability; fair compaction.
Alluvial land, loamy, wet: Ae.	Fair: seasonal high water table at a depth of 0 to 1 foot; flooding hazard.	Unsuitable: loamy material; excessive fines.	Fair: A–2, A–4; seasonal high water table limits accessibility; flooding hazard.	Seasonal high water table at a depth of 0 to 1 foot; flooding hazard.	Seasonal high water table at a depth of 0 to 1 foot; flooding hazard.	Fair stability; fair compaction; seasonal high water table at a depth of 0 to 1 foot.

significant to engineering—Continued

Percentage passing sieve—				Permeability	Available water capacity	Liquid limit	Plasticity index	Optimum moisture-content for compaction	Maximum dry density	Reaction (unlimed)	Shrink-swell potential
No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)								
				Inches per hour	*Inches per inch of soil*			*Percent of dry weight*	*Pounds per cubic foot*		*pH*
85–100	65–95	65–90	55–75	0. 63–2. 0	0. 20–0. 26	30–40	8–15	15–20	100–110	5. 6–7. 3	Low.
80–100	65–95	60–95	60–85	0. 63–2. 0	0. 16–0. 22	30–40	8–15	15–20	100–110	5. 6–7. 3	Moderate.
75–95	65–90	60–85	55–75	0. 63–2. 0	0. 16–0. 22	25–35	8–12	15–20	100–110	6. 6–7. 3	Moderate.
95–100	95–100	80–100	60–100	0. 2–2. 0	0. 14–0. 26	30–45	5–15	15–25	90–110	4. 5–6. 0	Low.
95–100	95–100	80–100	65–100	<0. 2	0. 10–0. 20	30–55	10–25	20–30	80–100	5. 1–6. 5	Moderate.
90–100	80–100	70–100	50–90	0. 2–2. 0	0. 12–0. 24	25–40	8–15	15–25	90–110	5. 6–6. 5	Low.

[1] NP means nonplastic.

engineering properties of the soils

n such mapping units may have different properties and limitations, and for this reason it is necessary to follow carefully the instructions n the first column of this table]

Soil features affecting—Continued						
Ponds—Con.	Drainage	Irrigation	Terraces and diversions	Grassed waterways	Frost-action potential	Land grading or smoothing
Excavated reservoirs						
Low water level in summer; pervious bedrock at a depth of 3½ to 5 feet.	Seasonal high water perched at a depth of ½ to 1½ feet; slow permeability.	High available water capacity; moderate intake rate; pan at shallow depth.	Seasonal high water perched at a depth of ½ to 1½ feet; seepage above pan.	Seasonal high water perched at a depth of ½ to 1½ feet; erodible slopes; seepage above fragipan.	Seasonal high water perched at a depth of ½ to 1½ feet; high capillary action.	Shallow depth to dense, root-restricting layer; erodibility.
Rapid recharge; seasonal high water table at a depth of 1 to 3 feet; drops several feet during summer.	Moderate permeability to a depth of 30 inches; flooding hazard.	Seasonal high water table at a depth of 1 to 3 feet; flooding hazard.	Not needed	Not needed	Seasonal high water table at a depth of 1 to 3 feet; high capillary action.	Seasonal high water table at a depth of 1 to 3 feet; flooding hazard.
Seasonal high water table at a depth of 0 to 1 foot; flooding hazard.	Seasonal high water table at a depth of 0 to 1 foot; moderate permeability to a depth of 30 inches; flooding hazard.	Seasonal high water table at a depth of 0 to 1 foot; flooding hazard.	Not needed	Not needed	Seasonal high water table at a depth of 0 to 1 foot; high capillary action.	Seasonal high water table at a depth of 0 to 1 foot; flooding hazard.

TABLE 9.—*Interpretations of*

Soil series and map symbol	Suitability as a source of—			Soil features affecting—		
	Topsoil	Sand and gravel	Road fill	Road location	Ponds	
					Reservoir area	Embankment material
*Annandale: AnB, AnC2, ApB, ApC. For Edneyville part of ApB and ApC, see Edneyville series.	Fair: angular gravel.	Poor: excessive fines; about 20 percent gravel.	Good to fair: A–4, A–6; substratum sandier; excessive cobblestones and stones in places.	Hard gneiss bedrock at a depth of 6 to 10 feet.	Sandy substratum permits seepage losses in places; bedrock at a depth of 6 to 10 feet.	Fair stability; fair compaction.
Athol: AtB, AtC2, AtD2.	Fair: angular gravel.	Unsuitable for sand. Poor for gravel; excessive fines; limited amount.	Fair: A–4, A–6; potential frost action.	High potential frost action; bedrock at a depth of 4 to 7 feet or more, cavernous in places.	Bedrock cavernous in places.	Fair to good stability; fair to good compaction.
Bedington: BaB, BaC2.	Fair: 15 to 30 percent shale fragments.	Unsuitable: excessive fines.	Fair: A–4, A–6, A–7; shale content increases with depth.	Fractured shale bedrock at a depth of 4 to 5½ feet or more.	Fractured bedrock permits seepage losses in places.	Fair to good stability; fair to good compaction; high shale content.
Berks: BbB, BbC2, BbD2.	Fair to poor: shale content very high in places.	Unsuitable: shaly; excessive fines.	Fair to good: A–1, A–2, A–4; shaly; bedrock at a depth of 1½ to 3½ feet.	Rippable shale bedrock at a depth of 1½ to 3½ feet; potential frost action.	Pervious bedrock at a depth of 1½ to 3½ feet.	Fair stability; fair to good compaction; limited amount above bedrock.
Birdsboro: BdA, BdB, BdC2.	Good	Generally unsuitable: sand or gravel beds, normally at a depth below 3½ feet, in places thick enough for use.	Fair: A–4, A–6 to a depth of about 5 feet; A–2 or A–4 below a depth of 5 feet; high potential frost action.	Moderate potential frost action.	Pervious substratum.	Fair to poor stability; fair to poor compaction; fair to poor resistance to piping.
Bowmansville: Bt	Good: seasonal high water table at a depth of 0 to 1 foot; flooding hazard.	Unsuitable: excessive fines.	Poor to fair: A–4, A–6; high potential frost action.	Seasonal high water table at a depth of 0 to 1 foot; high potential frost action; flooding hazard.	Pervious substratum; seasonal high water table at a depth of 0 to 1 foot; flooding hazard.	Fair to poor stability; fair to poor compaction; poor resistance to piping.
Bucks: BuB, BuC2	Good	Unsuitable: excessive fines.	Fair: A–4; high potential frost action.	High potential frost action; rippable shale bedrock at a depth of 3½ to 5 feet.	Pervious bedrock.	Fair to poor stability; fair to poor compaction; fair resistance to piping.

engineering properties of the soils—Continued

Soil features affecting—Continued						
Ponds—Con. Excavated reservoirs	Drainage	Irrigation	Terraces and diversions	Grassed waterways	Frost-action potential	Land grading or smoothing
Low water table; unsuitable.	Not needed	High available water capacity; moderate intake rate.	Hazard of erosion on strong slopes; stones in places.	Hazard of erosion on strong slopes; stones in places.	High capillary action.	Root-restricting pan at a depth of 2 to 3 feet; erodibility.
Low water table; pervious substratum; bedrock cavernous in places; unsuitable.	Not needed	High available water capacity; moderate intake rate.	Hazard of erosion on strong slopes; stone ledges.	Hazard of erosion on strong slopes; stone ledges in places.	High capillary action.	Stone ledges in places; erodibility.
Low water table; pervious bedrock; unsuitable.	Not needed	Moderate available water capacity; moderate intake rate.	Excessive shale content; bedrock at a depth of 4 to 5½ feet or more.	Excessive shale content; bedrock at a depth of 4 to 5½ feet or more; erodibility where slopes are long.	High capillary action.	Excessive shale content in places; bedrock at a depth of 4 to 5½ feet or more; erodibility where slopes are long.
Low water table; pervious bedrock; unsuitable.	Not needed	Moderate or low available water capacity; moderately rapid intake rate.	Shale bedrock at a depth of 1½ to 3½ feet.	Shale bedrock at a depth of 1½ to 3½ feet.	High capillary action.	Excessive shale content; shale bedrock at a depth of 1½ to 3½ feet; erodibility.
Low water table; pervious substratum; unsuitable.	Not needed	High available water capacity; moderate intake rate; moderate permeability.	Not needed	No unfavorable features.	High capillary action.	No unfavorable features.
Seasonal high water table at a depth of 0 to 1 foot; pervious substratum; flooding hazard.	Seasonal high water table at a depth of 0 to 1 foot; moderately slow permeability; flooding hazard.	Seasonal high water table at a depth of 0 to 1 foot; moderate intake rate; moderately slow permeability; drainage needed.	Not needed	Not needed	Seasonal high water table at a depth of 0 to 1 foot.	Seasonal high water table at a depth of 0 to 1 foot; flooding hazard.
Low water table; unsuitable.	Not needed	High available water capacity; moderate or moderately slow intake rate.	No unfavorable features.	No unfavorable features.	Capillary action.	No unfavorable features.

TABLE 9.—*Interpretations of*

Soil series and map symbol	Suitability as a source of—			Soil features affecting—		
	Topsoil	Sand and gravel	Road fill	Road location	Ponds	
					Reservoir area	Embankment material
Califon: CaA, CaB, CbB.	Good for CaA, CaB. Poor for CbB: high stone content.	Unsuitable: excessive fines.	Fair for CaA, CaB: A–4, A–6; potential frost action. Poor for CbB: high stone content.	High potential frost action; seasonal high water perched at a depth of ½ to 2½ feet; high stone content for CbB.	Seasonal high water perched at a depth of ½ to 2½ feet; pervious substratum permits seepage loss in some places; high stone content for CbB.	Fair to good stability; fair to good compaction; high stone content for CbB.
*Chalfont: CdA, CdB, CdC2, CeB, CfC, CgB. For Lehigh part of CfC, see Lehigh series; for Quakertown part of CgB, see Quakertown series.	Good for CdA, CdB, CdC2: seasonal high water limits accessibility. Poor for CeB, CfC: high stone content.	Unsuitable: excessive fines.	Fair to poor for CdA, CdB, CdC2: A–4, A–6; seasonal high water at a depth of ½ to 1½ feet. Poor for CeB, CfC: high stone content.	Seasonal high water at a depth of ½ to 1½ feet; bedrock at a depth of 3½ to 6 feet; high potential frost action. High stone content for CeB, CfC.	Seasonal high water perched at a depth of ½ to 1½ feet; pervious shale bedrock at a depth of 3½ to 6 feet.	Fair to poor stability; fair to poor compaction; high stone content for CeB, CfC.
Cokesbury: Co, Cp----	Good for Co: seasonal high water restricts accessibility. Poor for Cp: high stone content.	Unsuitable: excessive fines.	Fair to poor: A–4, A–6; potential frost action; seasonal high water table limits accessibility; high stone content for Cp.	Seasonal high water at a depth of 0 to 1 foot; high potential frost action; high stone content for Cp.	Seasonal high water at a depth of 0 to 1 foot.	Fair to good stability; fair to good compaction; high stone content for Cp.
Croton: CrA, CrB, CsB.	Good for CrA, CrB: seasonal high water restricts accessibility. Poor for CsB: high stone content.	Unsuitable: excessive fines.	Fair to poor: A–4, A–6, A–7; high potential frost action; seasonal high water perched at a depth of 0 to 1 foot; high stone content for CsB.	Seasonal high water perched at a depth of 0 to 1 foot; high potential frost action; high stone content for CsB.	Seasonal high water perched at a depth of 0 to 1 foot; shale bedrock at a depth of 3½ to 5 feet or more permits seepage losses in places; high stone content for CsB.	Fair to poor stability; fair to poor compaction; high stone content for CsB.

engineering properties of the soils—Continued

Soil features affecting—Continued						
Ponds—Con. Excavated reservoirs	Drainage	Irrigation	Terraces and diversions	Grassed waterways	Frost-action potential	Land grading or smoothing
Seasonal high water perched at a depth of ½ to 2½ feet, low in summer.	Seasonal high water perched at a depth of ½ to 2½ feet, low in summer; moderate permeability above pan and slow permeability in pan; pan is at a depth of 20 to 30 inches.	High available water capacity; moderate intake rate above pan.	Root-restricting pan at a depth of 20 to 30 inches.	Root-restricting pan at a depth of 20 to 30 inches.	Seasonal high water perched at a depth of ½ to 2½ feet; high capillary action.	Root-restricting pan at a depth of 20 to 30 inches.
Seasonal high water perched at a depth of ½ to 1½ feet, low in summer; pervious bedrock.	Seasonal high water perched at a depth of ½ to 1½ feet; moderate or moderately slow permeability above pan, slow permeability in pan; pan is at a depth of 15 to 30 inches; high stone content for CeB, CfC.	High available water capacity; moderately slow intake rate; slow permeability in pan; high stone content for CeB, CfC.	Seasonal high water table perched at a depth of ½ to 1½ feet; high stone content for CeB, CfC; CdC2 has high hazard of erosion.	Seasonal high water table at a depth of ½ to 1½ feet; high stone content for CeB, CfC; CdC2 has high hazard of erosion.	Seasonal high water perched at a depth of ½ to 1½ feet; high capillary action.	Seasonal high water perched at a depth of ½ to 1½ feet; CdC2 has high hazard of erosion.
Seasonal high water at a depth of 0 to 1 foot; pan at a depth of 20 to 30 inches; bedrock at a depth of 6 feet or more.	Seasonal high water at a depth of 0 to 1 foot; pan at a depth of 20 to 30 inches; slow permeability in pan; high stone content for Cp.	High available water capacity; seasonal high water at a depth of 0 to 1 foot; needs drainage; high stone content for Cp.	Not needed-----	Not needed-----	Seasonal high water at a depth of 0 to 1 foot; high capillary action.	Root-restricting pan at a depth of 20 to 30 inches; hard bedrock at a depth of 5 feet or more; high stone content for Cp.
Seasonal high water water perched at a depth of 0 to 1 foot; pervious shale bedrock at a depth of 3½ to 5 feet.	Seasonal high water perched at a depth of 0 to 1 foot; slow permeability in pan at a depth of 15 to 25 inches; high stone content for CsB.	High available water capacity; moderately slow intake rate; slow permeability in pan; needs drainage; high stone content for CsB.	Not needed-----	Not needed-----	Seasonal high water perched at a depth of 0 to 1 foot; high capillary action.	Seasonal high water perched at a depth of 0 to 1 foot; root-restricting pan at a depth of 15 to 25 inches; shale bedrock at a depth of 3½ to 5 feet; high stone content for CsB.

TABLE 9.—*Interpretations of*

Soil series and map symbol	Suitability as a source of—			Soil features affecting—		
	Topsoil	Sand and gravel	Road fill	Road location	Ponds	
					Reservoir area	Embankment material
Duffield: DuB, DuC2, DvC2, DwD2.	Good	Unsuitable: excessive fines.	Fair to poor: A–4, A–6; moderate shrink-swell potential; high potential frost action; high stone content for DvC2, DwD2.	High potential frost action; pervious limestone bedrock at a depth of 4 to 7 feet; bedrock cavernous in places; high stone content for DvC2, DwD2.	High seepage potential; bedrock cavernous in places.	Fair stability; fair compaction; high stone content for DvC2, DwD2.
*Edneyville: EdB, EdC2, EdD, EeC. For Parker part of EeC, see Parker series.	Fair for EdB, EdC2: moderate gravel content. Poor for EdD, EeC: moderate gravel content; high erosion hazard.	Poor for sand and gravel; excessive fines; limited supply above bedrock.	Good: moderate potential frost action; stony in places.	Moderate potential frost action; hard bedrock at a depth of 3½ to 6 feet or more.	Pervious substratum and bedrock permit seepage losses in places.	Fair stability; fair compaction; stony in places.
Hazleton: HaB, HaC2, HaD, HcC, HcE.	Poor: high amounts of sandstone fragments.	Unsuitable: soft sandstone; high stone content for HcC, HcE.	Fair: A–2, A–4; excessive sandstone fragments; high stone content for HcC, HcE.	Moderate frost action potential; rippable bedrock at a depth of 4 to 5 feet; high stone content for HcC, HcE.	Pervious bedrock; high stone content for HcC, HcE.	Fair to poor: excessive sandstone fragments; limited supply over bedrock; fair to good stability; high stone content for HcC, HcE.
Klinesville: KlC, KlD.	Poor: limited amount over shale at a shallow depth; high shale content.	Unsuitable: high shale content.	Fair: A–1, A–2, A–4; limited quantity of shaly material.	Rippable shale bedrock at a depth of 1 to 1½ feet; moderate potential frost action.	Pervious shale bedrock at a depth of 1 to 1½ feet.	Fair stability; fair to good compaction; limited borrow; high shale content.
Lansdale: LaB, LaC2, LaD.	Good: erosion hazard, LaC2, LaD.	Unsuitable: excessive fines.	Good: A–2, A–4; moderate potential frost action.	Sandstone bedrock at a depth of 3½ to 5 feet or more; moderate potential frost action.	Pervious substratum and bedrock permit seepage losses.	Fair to good stability; fair to good compaction.
Lansdowne: LbB	Good: seasonal high water limits accessibility.	Unsuitable: excessive fines.	Fair: A–4, A–6, A–7; seasonal high water limits accessibility.	Seasonal high water perched at a depth of 1 to 2½ feet; shale bedrock at a depth of 3½ to 5 feet; high potential frost action.	Pervious substratum and bedrock permit seepage losses.	Fair to poor stability; fair to poor compaction.

engineering properties of the soils—Continued

Soil features affecting—Continued						
Ponds—Con. Excavated reservoirs	Drainage	Irrigation	Terraces and diversions	Grassed waterways	Frost-action potential	Land grading or smoothing
Low water table; pervious bedrock; unsuitable.	Not needed-----	High available water capacity; moderate intake rate; high stone content for DvC2, DwD2.	Limestone ledges in places; high stone content for DvC2, DwD2.	Limestone ledges in places; high stone content for DvC2, DwD2; erodibility in areas of strong slopes.	High capillary action.	Stone ledges in places; high stone content in DvC2, DwD2, erodibility in areas of strong slopes.
Low water table; unsuitable.	Not needed-----	Moderate available water capacity.	No unfavorable features.	No unfavorable features.	Moderate capillary action.	No unfavorable features.
Low water table; pervious bedrock; unsuitable.	Not needed-----	Moderate or low available water capacity; moderate intake rate; moderately rapid permeability; high stone content for HcC, HcE.	Excessive sandstone fragments in places; high stone content for HcC, HcE; erodibility in areas of strong slopes.	Excessive sandstone fragments in places; high stone content for HcC, HcE; erodibility in areas of strong slopes.	Moderate capillary action.	Excessive sandstone fragments; bedrock at a depth of 4 to 5 feet; high stone content for HcC, HcE.
Low water level; unsuitable	Not needed-----	Low available water capacity; rapid intake rate.	High shale content; shale bedrock at a depth of 1 to 1½ feet.	High shale content; shale bedrock at a depth of 1 to 1½ feet.	Moderate capillary action.	Excessive shale fragments; shale bedrock at a depth of 1 to 1½ feet.
Pervious substratum and bedrock.	Not needed-----	Moderate available water capacity.	Fair to good stability.	Moderate available water capacity.	Moderate capillary action.	Bedrock at a depth of 3½ to 5 feet or more.
Low water in summer; shale bedrock at a depth of 3½ to 5 feet.	Slow permeability; seasonal high water at a depth of 1 to 2½ feet.	High available water capacity; moderate intake rate; slow permeability; seasonal high water at a depth of 1 to 2½ feet.	Fair to poor stability.	High available water capacity.	Seasonal high water at a depth of 1 to 2½ feet; high capillary action.	Seasonal high water at a depth of 1 to 2½ feet; highly plastic subsoil, rippable bedrock at a depth of 3½ to 5 feet.

TABLE 9.—*Interpretations of*

Soil series and map symbol	Suitability as a source of—			Soil features affecting—		
	Topsoil	Sand and gravel	Road fill	Road location	Ponds	
					Reservoir area	Embankment material
Lawrenceville: LeB, LeC2.	Good	Unsuitable: excessive fines.	Fair: A–4, A–6; high potential frost action.	Seasonal high water at a depth of 1½ to 3 feet.	Pervious substratum and bedrock permit seepage losses in places.	Fair to poor stability; fair to poor compaction; erodible.
Legore: LgB, LgC, LgD.	Fair: variable gravel content.	Poor: excessive fines.	Fair: A–4 at a depth of 2 feet; A–2, A–4 at a depth below 2 feet.	Hard bedrock at a depth of 5 to 8 feet.	Pervious substratum permits seepage losses.	Fair to good stability; fair to good compaction.
Lehigh: LhB, LhC2, LhD2, LkB, LkC.	Fair for LhB, LhC2, LhD2: seasonal high water table at a depth of ½ to 2 feet; high stone content for LkB, LkC.	Unsuitable: none present.	Fair: A–4, A–6; shale content increases with depth; high stone content for LkB, LkC.	Seasonal high water table at a depth of ½ to 2 feet; high potential frost action; high stone content for LkB, LkC.	Seasonal high water at a depth of ½ to 2 feet; fractured bedrock permits seepage losses in places.	Fair stability; fair compaction; high shale content in places; high stone content for LkB, LkC.
Made land: Ma. Variable, onsite investigation needed.						
Meckesville: MeB, MeC2.	Fair: variable gravel content.	Unsuitable: excessive fines.	Good to fair: A–4, A–6; moderate potential frost action.	Moderate potential frost action; bedrock at a depth of 5 to 8 feet or more.	Pervious substratum permits seepage losses.	Fair to good stability; low to moderate permeability when compacted.
*Mount Lucas: MoB, MwB. For Watchung part of MwB, see Watchung series.	Good: seasonal high water table limits accessibility.	Unsuitable: excessive fines.	Fair: A–4, A–6 at a depth of about 32 inches, A–2, A–4 below; high potential frost action.	Seasonal high water table at a depth of ½ to 2½ feet; high potential frost action.	Pervious substratum permits seepage losses in places.	Fair to poor stability; fair to poor compaction; seasonal high water table may limit accessibility.

engineering properties of the soils—Continued

Soil features affecting—Continued						
Ponds—Con. Excavated reservoirs	Drainage	Irrigation	Terraces and diversions	Grassed waterways	Frost-action potential	Land grading or smoothing
Low water in summer; shale bedrock at a depth of 3½ to 5 feet.	Moderately slow permeabilty in fragipan; pan at a depth of 24 to 35 inches; seasonal high water at a depth of 1½ to 3 feet.	High available water capacity; moderately slow permeability; moderately slow intake rate; seasonal high water table at a depth of 1½ to 3 feet.	Fair to poor stability; erodibility.	High available water capacity.	Seasonal high water at a depth of 1½ to 3 feet; high capillary action.	Root-restricting pan at a depth of 24 to 35 inches; shale bedrock is at a depth of 3½ to 7 feet; seasonal high water at a depth of 1½ to 3 feet.
Low water table; unsuitable.	Not needed-----	Moderate available water capacity; moderately slow to moderately rapid intake rate.	Fair to good stability; variable gravel content.	Erodibility in areas of moderate slopes.	Moderate capillary action.	Hard bedrock at a depth of 5 to 8 feet.
Water level at a depth below 3 feet in summer; seasonal high water table at a depth of ½ to 2 feet; shale bedrock at a depth of 3½ to 5 feet.	Seasonal high water table at a depth of ½ to 2 feet; slow permeability; high stone content for LkB, LkC.	Moderate available water capacity; high stone content for LkB, LkC.	Seasonal high water table at a depth of ½ to 2 feet; shale bedrock at a depth of 3½ to 5 feet; high stone content for LkB, LkC.	Seasonal high water table at a depth of ½ to 2 feet; shale bedrock at 3½ to 5 feet; high stone content for LkB, LkC.	Seasonal high water table at a depth of ½ to 2 feet; high capillary action.	Seasonal high water table at a depth of ½ to 2 feet; shale bedrock at a depth of 3½ to 5 feet; high stone content for LkB, LkC.
Low water table; unsuitable.	Not needed-----	High available water capacity; moderate intake rate; slow permeability in pan; pan at a depth of 26 to 40 inches.	No unfavorable features.	No unfavorable features.	Moderate capillary action.	Pan is at a depth of 26 to 40 inches.
Low water level in summer; seasonal high water table at a depth of ½ to 2½ feet.	Seasonal high water table at a depth of ½ to 2½ feet; moderately slow permeability.	Moderately slow intake rate; moderately slow permeability; seasonal high water at a depth of 1½ to 2½ feet.	Fair to poor stability; seasonal high water table at a depth of ½ to 2½ feet.	Seasonal high water table at a depth of ½ to 2½ feet; moderate available water capacity.	Seasonal high water table at a depth of ½ to 2½ feet; high capillary action.	Seasonal high water table at a depth of ½ to 2½ feet.

TABLE 9.—*Interpretations of*

Soil series and map symbol	Suitability as a source of—			Soil features affecting—		
	Topsoil	Sand and gravel	Road fill	Road location	Ponds	
					Reservoir area	Embankment material
*Neshaminy: NdB, NeB, NeC2, NhC, NhD, NhE, NkC. For Mount Lucas part of NkC, see Mount Lucas series.	Good for NeB, NeC2. Fair for NdB: variable gravel content. Poor for NhC, NhD, NhE, NkC: high stone content.	Unsuitable: none present.	Fair: A–4, A–6; low or moderate shrink-swell potential; high stone content for NhC, NhD, NhE, NkC.	Hard bedrock at a depth of 4 to 8 feet; moderate potential frost action; high stone content for NhC, NhD, NhE, NkC.	Hard bedrock at a depth of 4 to 8 feet; pervious substratum permits seepage losses in places.	Fair stability; fair compaction; high stone content for NhC, NhD, NhE, NkC.
Norton: NoB, NoC2, NoD2.	Good	Unsuitable: excessive fines.	Fair: A–4, A–6, A–7; low or moderate shrink-swell potential; potential frost action.	Moderate potential frost action; rippable shale bedrock at a depth of 4 to 10 feet.	Shale bedrock at a depth of 4 to 10 feet; little seepage.	Fair stability; fair compaction; moderate shrink-swell potential.
Parker: PaC, PaD	Poor: excessive content of stones, cobblestones, and gravel.	Poor for sand. Poor for gravel; excessive content of stones, cobblestones, and fines.	Good to poor: A–2, depending on proportion of stones; stone-free material is stable and compacts well.	Bedrock at a depth of 3½ to 6 feet; slope limitation; moderate or high stone content.	Rapidly permeable substratum; moderate or high cobblestone content.	Excessive stone content in places; stone-free material stable, compacts well, has low compressibility.
Pattenburg: PbB, PbC2, PbD, PbE.	Fair to poor: moderate to high gravel content.	Poor: excessive fines; many cobblestones; limited amount.	Good: A–1 and A–2; coarse fragment content increases with depth.	Bedrock at a depth of 3½ to 8 feet; moderately steep or steep slopes in PbD, PbE.	Pervious substratum permits seepage losses in places.	Excessive coarse fragments in places.
Pattenburg, moderately wet: PcB.	Fair to poor: moderate to high gravel content.	Poor: excessive fines; many cobblestones; limited amount.	Good: A–2 and A–4; coarse fragment content increases with depth.	Seasonal high water table at a depth of 1½ to 2½ feet; bedrock at a depth of 4 to 8 feet.	Pervious substratum permits seepage losses in places.	Excessive coarse fragments in places.
*Penn: PeB, PeC2, PeD, PfB, PfC2. For Bucks part of PfB and PfC2, see Bucks series.	Fair: variable shale fragment content.	Unsuitable: none present.	Fair: A–4, A–6; high shale content in places, moderate over bedrock at a depth of 1½ to 3½ feet; potential frost action.	Potential frost action; fractured shale bedrock at a depth of 1½ to 3½ feet.	Pervious soil and bedrock permit seepage losses.	Fair stability; fair compaction; shale fragments.

engineering properties of the soils—Continued

Soil features affecting—Continued						
Ponds—Con. Excavated reservoirs	Drainage	Irrigation	Terraces and diversions	Grassed waterways	Frost-action potential	Land grading or smoothing
Low water table; unsuitable.	Not needed	Moderate intake rate; moderately slow to moderate permeability; high available water capacity; high stone content for NhC, NhD, NhE, NkC.	Fair stability; high stone content for NhC, NhD, NhE, NkC.	High available water capacity; high stone content for NhC, NhD, NhE, NkC.	High capillary action.	Hard bedrock at a depth of 4 to 8 feet; high stone content for NhC, NhD, NhE.
Low water table; unsuitable.	Not needed	Moderate or moderately slow intake rate; slow permeability; high available water capacity.	Fair stability; erodibility.	High available water capacity.	High capillary action.	Highly plastic subsoil; shale bedrock at a depth of 4 to 10 feet.
Low water table; moderate or high stone content; unsuitable.	Not needed	Low available water capacity; moderately rapid intake rate in PaD; erodibility; slope limitation; high stone content.	Moderate stone content; PaD has stone limitation; erodibility.	Low available water capacity; high cobblestone and gravel content.	Moderate capillary action.	High stone, cobblestone, and gravel content; bedrock at a depth of 3½ to 6 feet.
Low water table; moderately rapid permeability; unsuitable.	Not needed	Moderately rapid intake rate; erodibility, PbC2, PbD, PbE.	Moderate gravel content; irregular slopes; PbD, PbE have slope limitations.	Moderate available water capacity; moderate to high gravel content.	Moderate capillary action.	High gravel content in subsoil; PbC2, PbD, PbE need deep cuts and fills; bedrock at a depth of 3½ to 8 feet.
Seasonal high water table at a depth of 1½ to 2½ feet; rapid recharge rate.	Seasonal high water table at a depth of 1½ to 2½ feet; moderate permeability.	Moderate available water capacity; moderate intake rate; seasonal high water table at a depth of 1½ to 2½ feet.	Not needed	Seasonal high water table at a depth of 1½ to 2½ feet; erodibility.	High capillary action; seasonal high water table at a depth of 1½ to 2½ feet.	High gravel content in subsoil; seasonal high water table at a depth of 1½ to 2½ feet.
Low water table; pervious bedrock; unsuitable.	Not needed	Moderate intake rate; moderately rapid permeability.	Fair stability; erodibility; many shale fragments in places; fractured shale bedrock at a depth of 1½ to 3½ feet.	Moderate or high available water capacity; fractured shale bedrock at a depth of 1½ to 3½ feet.	High capillary action.	Shale-fragment content increases with depth; shale bedrock at a depth of 1½ to 3½ feet.

TABLE 9.—*Interpretations of*

Soil series and map symbol	Suitability as a source of—			Soil features affecting—		
	Topsoil	Sand and gravel	Road fill	Road location	Ponds	
					Reservoir area	Embankment material
Pope: Pk	Fair: moderate available water capacity; moderate fertility.	Fair for sand and gravel at a depth below 30 inches; variable gravel content.	Good: A–2, A–4 to a depth of 30 inches; A–2, A–3 below.	Low potential frost action.	Pervious material permits seepage losses.	Fair stability; pervious material.
*Quakertown: QkA, QkB, QkC2, QkD2, QlC2. For Chalfont part of QlC2, see Chalfont series.	Good	Unsuitable: none present.	Fair: A–4, A–6; potential frost action.	Potential frost action; bedrock at a depth of 3½ to 6 feet.	Pervious bedrock permits seepage losses in places.	Fair to good stability; fair to good compaction.
Raritan: RbA, RbB	Good: seasonal high water limits accessibility in winter and in spring.	Poor: excessive fines; sand and gravel beds at a depth below 5 feet are extensive enough to be extracted; unpredictable occurrence.	Fair: A–4, A–6; potential frost action; seasonal high water limits accessibility.	Seasonal high water at a depth of 1 to 2 feet; high potential frost action.	Seasonal high water at a depth of 1 to 2 feet; pervious substratum permits seepage losses.	Fair stability; fair to good compaction.
Readington: RcB, RcC2.	Good: seasonal high water at a depth of 1½ 3 feet.	Unsuitable: none present.	Fair: A–4, A–6; high potential frost action; shrink-swell potential.	Seasonal high water perched at a depth of 1½ to 3 feet; high potential frost action; seepage above pan.	Seasonal high water perched at a depth of 1½ to 3 feet; pervious shale at a depth of 3½ to 5 feet.	Fair stability; fair compaction.
Reaville: ReA, ReB, ReC2.	Good: seasonal high water table at a depth of 1 to 2 feet.	Unsuitable: none present.	Fair: A–4, A–6; limited supply over bedrock at a depth of 1½ to 3½ feet; seasonal high water table at a depth of 1 to 2 feet.	Seasonal high water table at a depth of 1 to 2 feet; shale bedrock at a depth of 1½ to 3½ feet; high potential frost action.	Seasonal high water table at a depth of 1 to 2 feet; pervious shale bedrock at a depth of 1½ to 3½ feet.	Fair stability; fair compaction; variable shale content.
Reaville, wet variant: RfA, RfB.	Good: seasonal high water table at a depth of 0 to 1 foot.	Unsuitable: none present.	Fair: A–4, A–6; limited supply over bedrock at a depth of 1½ to 2½ feet; seasonal high water at a depth of 0 to 1 foot.	Seasonal high water at a depth of 0 to 1 foot; shale bedrock at a depth of 1½ to 2½ feet; high potential frost action.	Seasonal high water at a depth of 0 to 1 foot; pervious shale bedrock at a depth of 1½ to 2½ feet.	Fair stability; fair compaction; variable shale content.

engineering properties of the soils—Continued

Soil features affecting—Continued						
Ponds—Con. Excavated reservoirs	Drainage	Irrigation	Terraces and diversions	Grassed waterways	Frost-action potential	Land grading or smoothing
Low water table; unsuitable.	Not needed	Moderate available water capacity; moderate intake rate; moderately rapid permeability.	Not needed	Moderate available water capacity; moderate fertility.	Moderate capillary action.	No unfavorable features.
Low water table; unsuitable.	Not needed	Moderate intake rate; moderately slow permeability; high available water capacity.	Fair stability	High available water capacity.	High capillary action.	Coarse-fragment content increases rapidly with depth; bedrock at a depth of 3½ to 6 feet.
Seasonal high water perched at a depth of 1 to 2 feet, lower in summer; stratified sand and gravel permit seepage.	Seasonal high water perched at a depth of 1 to 2 feet; moderately slow permeability.	Moderate intake rate; moderately slow permeability; high available water capacity.	Root-restricting pan at a depth of 20 to 30 inches; seasonal high water perched at a depth of 1 to 2 feet.	High available water capacity.	Seasonal high water perched at a depth of 1 to 2 feet; high capillary action.	Fragipan at a depth of 20 to 30 inches.
Seasonal high water perched at a depth of 1½ to 3 feet, lower in summer.	Seasonal high water perched over pan at a depth of 1½ to 3 feet; moderately slow to moderate permeability.	Moderate intake rate; moderately slow to moderate permeability in pan.	Seasonal high water perched over pan at a depth of 1½ to 3 feet; seepage above pan.	High available water capacity; seasonal high water perched at a depth of 1½ to 3 feet.	Seasonal high water perched at a depth of 1½ to 3 feet; high capillary action.	Root-restricting pan at a depth of 24 to 36 inches; shale bedrock at a depth of 3½ to 5 feet.
Pervious shale bedrock at a depth of 1½ to 3½ feet; seasonal high water table at a depth of 1 to 2 feet.	Seasonal high water table at a depth of 1 to 2 feet; slow permeability.	Seasonal high water table at a depth of 1 to 2 feet; slow permeability.	Fair to poor stability; shale bedrock at a depth of 1½ to 3½ feet.	Seasonal high water table at a depth of 1 to 2 feet; shale bedrock at a depth of 1½ to 3½ feet; erodibility.	Seasonal high water table at a depth of 1 to 2 feet; high capillary action.	Shale bedrock at a depth of 1½ to 3½ feet; seasonal high water table at a depth of 1 to 2 feet; erodibility.
Pervious shale bedrock at a depth of 1½ to 2½ feet; seasonal high water at a depth of 0 to 1 foot.	Seasonal high water table at a depth of 0 to 1 foot; moderately slow permeability.	Seasonal high water table at a depth of 0 to 1 foot; bedrock at a depth of 1½ to 2½ feet.	Shale bedrock at a depth of 1½ to 2½ feet; seasonal high water table at a depth of 0 to 1 foot.	Seasonal high water at a depth of 0 to 1 foot; shale bedrock at a depth of 1½ to 2½ feet; erodibility.	Seasonal high water table at a depth of 0 to 1 foot; high capillary action.	Shale bedrock at a depth of 1½ to 2½ feet; seasonal high water table at a depth of 0 to 1 foot; erodibility.

TABLE 9.—*Interpretations of*

Soil series and map symbol	Suitability as a source of—			Soil features affecting—		
	Topsoil	Sand and gravel	Road fill	Road location	Ponds	
					Reservoir area	Embankment material
Riverhead: RgB, RgC	Poor: moderate available water capacity; moderate fertility; variable content of gravel and cobblestones.	Fair	Good: A–2, A–3.	Low potential frost action; low shrink-swell potential.	Pervious material permits seepage losses.	Good stability; fair to good compaction; pervious.
Rock land, Edneyville material: Rk.	Fair: variable gravel content.	Unsuitable: supply too limited to extract.	Poor: areas dominated by rocks and boulders.	Many large rocks, boulders, and steep slopes make roads impractical.	Not applicable	Many rocks and boulders.
Rough broken land, shale: RlF.	Unsuitable: little present.	Unsuitable: none present.	Unsuitable: shale bedrock.	Steep slopes; shale bedrock.	Not applicable	Unsuitable; high shale content.
Rowland: Ro	Good: seasonal high water table at a depth of 1 to 2½ feet limits accessibility in winter and in spring; flooding hazard.	Unsuitable above a depth of 40 inches; sand and gravel beds common below a depth of 40 inches near ground water level; flooding hazard.	Fair: A–4, A–6 to a depth of 40 inches; low or moderate shrink-swell potential; potential frost action; flooding hazard; seasonal high water table at a depth of 1 to 2½ feet.	Flooding hazard; seasonal high water table at a depth of 1 to 2½ feet; high potential frost action.	Flooding hazard; seasonal high water table at a depth of 1 to 2½ feet; high potential. frost action.	Fair stability; fair compaction.
Steep stony land, Parker material: SpF.	Unsuitable: little present.	Unsuitable: none present.	Unsuitable: small supply; steep slopes.	Steep slopes	Not applicable	Not applicable
Turbotville: TuB	Good: seasonal high water at a depth of ½ to 1½ feet.	Unsuitable: none present.	Fair: A–4, A–6; seasonal high water perched at a depth of ½ to 1½ feet; high potential frost action.	Seasonal high water perched at a depth of ½ to 1½ feet; high potential frost action.	Seasonal high water perched at a depth of ½ to 1½ feet; bedrock at a depth of 5 to 8 feet or more.	Fair stability; fair compaction.
Washington: WaB, WaC2.	Good	Unsuitable: none present.	Fair: A–4, A–6; moderate shrink-swell potential; moderate potential frost action.	Moderate potential frost action.	Pervious substratum and bedrock permit seepage losses; bedrock cavernous in places.	Fair stability; fair compaction.
Watchung: Wc	Good: seasonal high water table at a depth of 0 to 1 foot limits accessibility in winter and in spring.	Unsuitable: none present.	Poor: A–4, A–6, A–7; moderate shrink-swell potential; high potential frost action.	Seasonal high water table at a depth of 0 to 1 foot; high potential frost action.	Seasonal high water table at a depth of 0 to 1 foot.	Fair stability; fair compaction; moderate shrink-swell potential

engineering properties of the soils—Continued

Soil features affecting—Continued						
Ponds—Con. Excavated reservoirs	Drainage	Irrigation	Terraces and diversions	Grassed waterways	Frost-action potential	Land grading or smoothing
Low water table; unsuitable.	Not needed	Moderate available water capacity; moderate intake rate; moderate permeability.	No unfavorable features.	Moderate available water capacity.	Moderate capillary action.	Coarse texture at a depth of about 30 inches.
Low water table; unsuitable.	Not needed	Not needed	Not needed	Not needed	Moderate capillary action.	Not applicable.
Low water table; unsuitable.	Not needed	Not needed	Not needed	Not needed	Moderate capillary action.	Not applicable.
Flooding hazard; rapid recharge rates.	Seasonal high water table at a depth of 1 to 2½ feet; flooding hazard; moderate or moderately slow permeability.	Flooding hazard; seasonal high water table at a depth of 1 to 2½ feet.	Not needed	Not needed	High capillary action; seasonal high water table at a depth of 1 to 2½ feet.	Frequent flooding.
Low water table; steep slopes; unsuitable.	Not needed	Not needed	Not needed	Not needed	Not applicable	Not applicable.
Low water in summer; bedrock cavernous in places.	Seasonal high water perched at a depth of ½ to 1½ feet; moderately slow permeability in pan.	High available water capacity; moderate to moderately slow intake rate.	Seasonal high water perched at a depth of ½ to 1½ feet; pan at a depth of 20 to 30 inches.	High available water capacity; root-restricting pan at a depth of 20 to 30 inches.	Seasonal high water table perched at a depth of ½ to 1½ feet; high capillary action.	Root-restricting pan at a depth of 20 to 30 inches, bedrock at a depth of 5 to 8 feet or more.
Low water table; bedrock cavernous in places; unsuitable.	Not needed	Moderate intake; moderate permeability; high available water capacity.	Fair stability; ledges in places.	High available water capacity; ledges in places; erodibility.	High capillary action.	Limestone ledges in places; bedrock at a depth of 5 to 8 feet or more; erodibility.
Seasonal high water table at a depth of 0 to 1 foot; hard bedrock.	Seasonal high water table at a depth of 0 to 1 foot; slow permeability.	Seasonal high water table at a depth of 0 to 1 foot; high available water capacity.	Not needed	Not needed	Seasonal high water table at a depth of 0 to 1 foot; high capillary action.	Seasonal high water table at a depth of 0 to 1 foot; hard bedrock at a depth of 5 to 8 feet or more.

Available water capacity, expressed in table 8 in inches per inch of soil depth, is the approximate amount of water that a soil holds when wet to field capacity. If the soil is air dry, this amount of water will wet it to a depth of 1 inch without deeper penetration (*5*).

Liquid limit and *plasticity index* indicate the effect of water on the strength and consistence of soil material. As the moisture content of a clayey soil is increased from a dry state, the material changes from a semisolid to a plastic state. If the moisture content is further increased, the material changes from a plastic to a liquid state. The *plastic limit* is the moisture content at which the soil material changes from a semisolid to a plastic state and the *liquid limit*, from a plastic to a liquid state. The *plasticity index* is the numerical difference between the liquid limit and the plastic limit. It indicates the range of moisture content within which a soil material is plastic.

Optimum moisture content for compaction in table 8 is for that part of the sample passing a No. 4 sieve. It is the moisture content that gives the maximum dry density for a specific method of compaction. *Maximum dry density* is the highest dry unit weight of a soil that has been compacted when moisture content is optimum.

The *reaction*, or pH, given in table 8 is that which would be expected for a soil in its natural, or untreated, state. Heavy applications of lime, however, have raised the pH of most farmed soils in the county.

The *shrink-swell potential* indicates the volume change to be expected when the content of soil moisture changes. It is estimated primarily on the basis of the amount and type of clay in a horizon. In this table shrink-potential is rated *low*, *moderate*, or *high*.

Engineering interpretations

In table 9 are given suitability ratings for soils in Hunterdon County as sources of topsoil, sand and gravel, and road fill and features of the soils that affect stated engineering practices. These interpretations are based on the test data shown in table 7, the estimated soil properties given in table 8, and experience in using the soils in Hunterdon County and other parts of the state.

Topsoil is used for topdressing an area where vegetation is to be established and maintained. Suitability is affected mainly by ease of working and spreading the soil material when preparing a seedbed; natural fertility of the material, or the response of plants when fertilizer is applied; and absence of substances toxic to plants. Texture of the soil material and its content of stone fragments are characteristics that affect suitability. Also considered in the ratings, however, is the damage that will result to the area from which topsoil is taken.

Sand and gravel are used in great quantities in many kinds of construction. The ratings in table 9 provide guidance on where to look for probable sources. A soil rated as a *good* or *fair* source of sand or gravel generally has a layer at least 3 feet thick, the top of which is within a depth of 6 feet. The ratings do not take into account thickness of overburden, location of the water table, or other factors that affect mining of the materials, nor do they indicate quality of the deposit.

Road fill is soil material used in embankments for roads. The suitability ratings reflect (1) the predicted performance of soil after it has been placed in an embankment that has been properly compacted and provided with adequate drainage and (2) the relative ease of excavating the material at borrow areas.

Road location suitability is based on the assumption that there will be an all-weather surface; a subgrade of underlying soil material; a base of gravel, crushed rock, or soil material stabilized with lime or cement; and a flexible or rigid surface that is commonly asphalt or concrete.

Pond reservoir areas hold water behind a dam or embankment. Soils suitable for pond reservoir areas have low seepage, which is related to their permeability and depth to fractured or permeable bedrock or other permeable material.

The column *Embankment material* in table 9 lists properties and major behavioral qualities that affect the performance of soils if used in constructing earth fills intended for holding back water.

In the column *Excavated reservoirs* are properties that are important to the construction and operation of groundwater ponds. Recharge rates are given, if known.

Drainage is affected by such soil properties as permeability, texture, and structure; depth to claypan, rock, or other layers that influence rate of water movement; depth to the water table; slope; stability in ditchbanks; susceptibility to stream overflow; salinity or alkalinity; and availability of outlets for drainage.

Irrigation is affected by such features as the following: slope; susceptibility to stream overflow, water erosion, or soil blowing; soil texture; content of stones; accumulations of salts and alkali; depth of root zone; rate of water intake at the surface; permeability of soil layers below the surface layer and in fragipans or other layers that restrict movement of water; amount of water held available to plants; need for drainage; and depth to water table or bedrock.

Terraces and diversions are low ridges constructed across the slope to intercept or divert runoff so that it soaks into the soil or flows slowly to a prepared outlet. Features that affect suitability of a soil for terraces are uniformity and steepness of slope; depth to bedrock or other unfavorable material: presence of stones; permeability; and resistance to water erosion, soil slipping, and soil blowing. A soil suitable for these structures provides outlets for runoff and is not difficult to vegetate.

The factors listed in the column *Grassed waterways* are those that affect establishment, growth, and maintenance of plants and layout and construction of waterways.

Frost-action potential refers to the probable effects on structures resulting from the freezing of soil material and its subsequent thawing.

Land grading or smoothing gives the properties of soils involved if soils are graded to a depth of 1 or 2 feet.

Interpretations in table 9 relate to the entire profile unless there are horizons within the profile that have different properties of engineering significance.

The soil features that affect engineering practices are mainly those that limit use. Favorable features, however, are noted in some places.

The engineering interpretations reported here do not eliminate the need for sampling and testing at the site of specific engineering works involving heavy loads and where the excavations are deeper than the depths of layers here reported. Estimates generally are made to a depth of about 5 feet, and interpretations do not apply to greater

depths. Also, engineers should not apply specific values to the estimates for bearing capacity and traffic-supporting capacity given in this survey. Investigation of each site is needed because many delineated areas of a given soil mapping unit may contain small areas of other kinds of soil that have strongly contrasting properties and different suitabilities or limitations for soil engineering. Even in these situations, however, the soil map is useful in planning more detailed field investigations and for indicating the kinds of problems that may be expected.

Some of the terms used in this soil survey have special meaning to soil scientists not known to all engineers. Many of the terms commonly used in soil science are defined in the Glossary at the back of this survey.

Town and Country Planning

This section was prepared mainly for planners, developers, zoning officials, landowners, and prospective landowners. Table 10 shows the relative degree of limitation of each soil in the county for specified uses related to town and country planning (*10*). Planners and zoning officials who are interested in evaluating the suitability of the soils for such uses, as opposed to their agricultural capability, will be interested in the section "Capability Grouping." Readers needing more information about individual soils should refer to the section "Descriptions of the Soils." Explanations of the uses covered in table 10 follow.

Septic effluent disposal.—Soil properties to be considered include flood hazard, depth to seasonal water table, slope, depth to and kind of bedrock, rockiness, stoniness, and permeability at a depth of about 30 inches.

It is presumed that all sites having a moderately high water table will either be drained or filled to alleviate the condition. Where more permeable layers occur at depths below 30 inches, it is presumed that some deep ditching will be done to reach the more permeable stratum.

Because soils are variable, percolation tests might reveal suitable disposal areas in the midst of generally unfavorable soils. Where soils are only moderately deep to bedrock, it is often more practical to design and construct drainage beds for disposal areas rather than trenches.

The soil interpretations do not eliminate the need for onsite percolation tests, but the information can assist the health administrative authority to determine general areas where additional subsoil and ground water information should be required. Percolation tests made during dry seasons seldom indicate the seasonal ground-water hazard nor do they reflect the wet-season percolation rates.

Foundations for dwellings with basements.—It is assumed that excavations will be done by earthmoving equipment. Soil properties used in the ratings are susceptibility to flooding, depth to and kind of bedrock, depth to seasonal high water table, slope, rockiness and stoniness (fig. 18).

Foundations for dwellings without basements.—Soil properties used in the ratings are the same as those for dwellings that have basements, except criteria are not so strict for depth to bedrock and depth to water table. Soil properties used in ratings for commercial buildings are similar to those for dwellings, but criteria are more severe for slope. The ratings do not apply to industrial buildings that have abnormal weight or vibration.

Lawns and landscaping.—Primary soil properties used in rating are susceptibility to flooding, depth of water table, slope, depth to bedrock, rockiness, stoniness, content of coarse fragments, and texture of the surface layer.

***Figure 18.*—Stones and boulders in Neshaminy very stony silt loam limit its use for foundations of dwellings that have basements.**

Local roads.—Primary soil properties used in rating are susceptibility to flooding, depth to seasonal high water, slope, depth to and kind of bedrock, rockiness, stoniness, and frost-action potential.

Parking lots.—Primary soil properties used in rating are the same as those for local roads; but the criteria are more strict, especially for slope, stoniness, and rockiness.

Athletic fields.—It is presumed that all-season use is desired. Primary soil properties used in rating are susceptibility to flooding, depth to seasonal high water table, slope, depth to bedrock, rockiness, stoniness, content of coarse fragments in the surface layer, texture of the surface layer, and permeability.

Picnic areas.—Late spring, summer, and fall use is presumed. Primary soil properties used in rating are susceptibility to flooding, depth to water table, slope, rockiness, stoniness, content of coarse fragments in the surface layer, and texture of the surface layer.

Campsites (trailers and tents).—Primary soil properties used in rating are susceptibility to flooding, depth to seasonal water table, slope, depth to bedrock, rockiness, stoniness, content of coarse fragments in the surface layer, texture of the surface layer, and permeability. Ratings in these tables generally are for late in spring and summer. They would be more severe if all-season camping was contemplated.

Sanitary landfill.—It is presumed that the trench method will be used, and that deep onsite investigations of the soil and water properties will be made below a depth of 5 feet.

Primary soil properties used in the ratings are susceptibility to flooding, depth to seasonal high water table, slope, depth to and kind of bedrock, rockiness, stoniness, permeability at depths below 5 feet, and depth of filterable soil material. Because permeability is rapid in gravel beds or cavernous limestone, the pollution hazard is also included in these ratings.

Cemeteries.—Primary soil properties used in the ratings are susceptibility to flooding, slope, depth to water table, depth to bedrock, rockiness, and stoniness.

TABLE 10.—*Limitations for uses*

Soil	Disposal of sewage effluent (onsite)[1]	Foundations for dwellings—		Lawns and landscaping	Local roads
		With basements	Without basements		
Abbottstown silt loam, 0 to 2 percent slopes: AbA.	Severe: seasonal high water at a depth of ½ to 1½ feet.	Severe: seasonal high water at a depth of ½ to 1½ feet.	Moderate: seasonal high water at a depth of ½ to 1½ feet.	Moderate: seasonal high water at a depth of ½ to 1½ feet.	Severe: seasonal high water at a depth of ½ to 1½ feet; high frost-action potential.
Abbottstown silt loam, 2 to 6 percent slopes: AbB.	Severe: seasonal high water at a depth of ½ to 1½ feet.	Severe: seasonal high water at a depth of ½ to 1½ feet.	Moderate: seasonal high water at a depth of ½ to 1½ feet.	Moderate: seasonal high water at a depth of ½ to 1½ feet.	Severe: seasonal high water at a depth of ½ to 1½ feet; high frost-action potential.
Alluvial land, loamy: Ac.	Severe: flooding	Severe: flooding	Severe: flooding	Moderate: seasonal high water table at a depth of ½ to 3 feet; flooding.	Severe: flooding
Alluvial land, loamy, wet: Ae.	Severe: flooding	Severe: flooding	Severe: flooding	Moderate: seasonal high water table at a depth of 0 to 1 foot; flooding.	Severe: flooding
Annandale gravelly loam, 3 to 8 percent slopes: AnB.	Moderate: moderately slow permeability in pan; deep trenches generally needed.	Slight	Slight	Slight: gravel in places.	Moderate: frost-action potential.
Annandale gravelly loam, 8 to 15 percent slopes, eroded: AnC2.	Moderate: moderately slow permeability in pan; deep trenches generally needed.	Moderate: strong slopes.	Moderate: strong slopes.	Moderate: strong slopes; gravel in places.	Moderate: strong slopes; frost-action potential.
Annandale and Edneyville gravelly loams, 3 to 8 percent slopes: ApB.					
Annandale	Moderate: moderately slow permeability in pan; deep trenches generally needed.	Slight	Slight	Slight: gravel in places.	Moderate: frost-action potential.
Edneyville	Moderate: hard bedrock normally at a depth of 4 to 6 feet.	Moderate: hard bedrock at a depth of 4 to 6 feet.	Slight	Moderate: gravel content exceeds 20 percent in most places.	Moderate: frost-action potential.

See footnote at end of table.

related to town and country planning

Parking lots	Athletic fields	Picnic areas	Campsites (trailers and tents)	Sanitary landfill [1]	Cemeteries
Severe: seasonal high water at a depth of ½ to 1½ feet; high frost-action potential.	Severe: seasonal high water at a depth of ½ to 1½ feet.	Moderate: seasonal high water at a depth of ½ to 1½ feet.	Severe: seasonal high water at a depth of ½ to 1½ feet.	Severe: seasonal high water at a depth of ½ to 1½ feet; rippable shale bedrock at a depth of 3½ to more than 5 feet.	Severe: seasonal high water at a depth of ½ to 1½ feet; rippable shale bedrock at a depth of 3½ to more than 5 feet.
Severe: seasonal high water at a depth of ½ to 1½ feet; high frost-action potential.	Severe: seasonal high water at a depth of ½ to 1½ feet.	Moderate: seasonal high water at a depth of ½ to 1½ feet.	Severe: seasonal high water at a depth of ½ to 1½ feet.	Severe: seasonal high water at a depth of ½ to 1½ feet; rippable shale bedrock at a depth of 3½ to more than 5 feet.	Severe: seasonal high water at a depth of ½ to 1½ feet; rippable shale bedrock at a depth of 3½ to more than 5 feet.
Severe: flooding----	Severe: flooding----	Moderate: water table normally below a depth of 20 inches in picnic season; flooding.	Severe: flooding----	Severe: flooding----	Severe: flooding.
Severe: flooding----	Severe: flooding----	Severe: water table within 20 inches of the surface in picnic season; flooding.	Severe: flooding----	Severe: flooding----	Severe: flooding.
Moderate: frost-action potential.	Moderate: gentle slopes.	Slight----------	Slight----------	Slight where bedrock is below a depth of 8 feet; moderate where bedrock is at a depth between 6 and 8 feet.	Slight.
Severe: strong slopes.	Severe: strong slopes.	Moderate: strong slopes.	Moderate: strong slopes.	Moderate: strong slopes; hard bedrock at a depth of less than 8 feet.	Slight.
Moderate: frost-action potential.	Moderate: gentle slopes.	Slight----------	Slight----------	Slight where bedrock is below a depth of 8 feet; moderate where bedrock is at a depth of 6 to 8 feet.	Slight.
Moderate: gentle slopes; frost-action potential.	Severe: gravel content exceeds 20 percent in most places.	Slight----------	Slight----------	Severe: hard bedrock at a depth of 3½ to 6 feet.	Severe: hard bedrock at a depth of 3½ to 6 feet.

TABLE 10.—*Limitations for uses related*

Soil	Disposal of sewage effluent (onsite)[1]	Foundations for dwellings—		Lawns and landscaping	Local roads
		With basements	Without basements		
Annandale and Edneyville gravelly loams, 8 to 15 percent slopes: ApC.					
Annandale	Moderate: moderately slow permeability in pan; deep trenches generally needed.	Moderate: strong slopes.	Moderate: strong slopes.	Moderate: strong slopes; gravel in places.	Moderate: strong slopes; frost-action potential.
Edneyville	Moderate: hard bedrock normally at a depth of 4 to 6 feet.	Moderate: hard bedrock at a depth of 4 to 6 feet.	Slight	Moderate: gravel content exceeds 20 percent in most places; strong slopes.	Moderate: strong slopes; frost-action potential.
Athol gravelly loam, 2 to 6 percent slopes: AtB.	Moderate: bedrock at a depth of 4 to 7 feet.	Slight	Slight	Slight: gravel in places.	Moderate: frost-action potential.
Athol gravelly loam, 6 to 12 percent slopes, eroded: AtC2.	Moderate: strong slopes; bedrock at a depth of 4 to 7 feet.	Slight	Slight	Moderate: strong slopes; gravel in places.	Moderate: strong slopes; frost-action potential.
Athol gravelly loam, 12 to 18 percent slopes, eroded: AtD2.	Severe: moderately steep slopes.	Moderate: moderately steep slopes.	Moderate: moderately steep slopes.	Severe: moderately steep slopes.	Severe: moderately steep slopes.
Bedington shaly silt loam, 2 to 6 percent slopes: BaB.	Moderate: bedrock generally at a depth of less than 6 feet.	Slight: rippable bedrock generally at a depth of less than 6 feet.	Slight	Slight: shale fragments in places.	Moderate: frost-action potential; rippable shale bedrock generally at a depth of less than 6 feet.
Bedington shaly silt loam, 6 to 12 percent slopes, eroded: BaC2.	Moderate: bedrock generally at a depth of less than 6 feet.	Slight: rippable bedrock generally at a depth of less than 6 feet.	Slight	Moderate: strong slopes; variable shale content.	Moderate: frost-action potential; rippable shale bedrock generally at a depth of less than 6 feet.
Berks shaly loam, 2 to 6 percent slopes: BbB.	Severe: bedrock at a depth of 1½ to 3½ feet.	Moderate: rippable shale bedrock at a depth of 1½ to 3½ feet.	Slight	Moderate: shale fragment content commonly exceeds 20 percent.	Moderate: rippable shale bedrock at a depth of 1½ to 3½ feet.
Berks shaly loam, 6 to 12 percent slopes, eroded: BbC2.	Severe: bedrock at a depth of 1½ to 3½ feet.	Moderate: rippable shale bedrock at a depth of 1½ to 3½ feet.	Slight	Moderate: shale fragment content commonly exceeds 20 percent.	Moderate: rippable shale bedrock at a depth of 1½ to 3½ feet.
Berks shaly loam, 12 to 18 percent slopes, eroded: BbD2.	Severe: moderately steep slopes; bedrock at a depth of 1½ to 3½ feet.	Moderate: moderately steep slopes; rippable shale bedrock at a depth of 1½ to 3½ feet.	Moderate: moderately steep slopes.	Severe: moderately steep slopes.	Severe: moderately steep slopes; rippable shale bedrock at a depth of 1½ to 3½ feet.

See footnote at end of table.

to town and country planning—Continued

Parking lots	Athletic fields	Picnic areas	Campsites (trailers and tents)	Sanitary landfill[1]	Cemeteries
Severe: strong slopes.	Severe: strong slopes.	Moderate: strong slopes.	Moderate: strong slopes.	Moderate: strong slopes; hard bedrock at a depth of less than 8 feet.	Slight.
Severe: strong slopes.	Severe: strong slopes; gravel content exceeds 20 percent in most places.	Moderate: strong slopes.	Moderate: strong slopes.	Severe: hard bedrock at a depth of 3½ to 6 feet.	Severe: hard bedrock at a depth of 3½ to 6 feet.
Moderate: gentle slopes; frost-action potential.	Moderate: gentle slopes; coarse fragments.	Slight	Slight	Severe: bedrock at a depth of 4 to 7 feet.	Moderate: bedrock at a depth of 4 to 7 feet.
Severe: strong slopes; frost-action potential.	Severe: strong slopes.	Moderate: strong slopes.	Moderate: strong slopes.	Severe: bedrock at a depth of 4 to 7 feet.	Moderate: bedrock at a depth of 4 to 7 feet.
Severe: moderately steep slopes.	Severe: slopes	Severe: slopes	Severe: moderately steep slopes.	Severe: slopes; bedrock at a depth of 4 to 7 feet.	Moderate: bedrock at a depth of 4 to 7 feet.
Moderate: frost-action potential; rippable shale bedrock generally at a depth of less than 6 feet.	Moderate: where shale content is less than 20 percent. Severe: where shale content exceeds 20 percent.	Slight	Slight	Severe: bedrock generally at a depth of less than 6 feet.	Moderate: rippable bedrock generally at a depth of less than 6 feet.
Severe: slopes	Severe: slopes	Moderate: strong slopes.	Moderate: strong slopes.	Severe: bedrock generally at a depth of less than 6 feet.	Moderate: rippable bedrock generally at a depth of less than 6 feet.
Moderate: rippable shale bedrock at a depth of 1½ to 3½ feet.	Severe: slopes; rippable bedrock at a depth of 1½ to 3½ feet; many shale fragments.	Slight	Slight: shale fragments.	Severe: bedrock at a depth of 1½ to 3½ feet.	Severe: bedrock at a depth of 1½ to 3½ feet.
Severe: slopes; rippable shale bedrock at a depth of 1½ to 3½ feet.	Severe: slopes; rippable shale bedrock at a depth of 1½ to 3½ feet; many shale fragments.	Moderate: strong slopes.	Moderate: strong slopes.	Severe: bedrock at a depth of 1½ to 3½ feet.	Severe: bedrock at a depth of 1½ to 3½ feet.
Severe: moderately steep slopes; rippable shale bedrock at a depth of 1½ to 3½ feet.	Severe: moderately steep slopes; rippable shale bedrock at a depth of 1½ to 3½ feet; many shale fragments.	Severe: moderately steep slopes.	Severe: moderately steep slopes.	Severe: moderately steep slopes; bedrock at a depth of 1½ to 3½ feet.	Severe: bedrock at a depth of 1½ to 3½ feet.

TABLE 10.—*Limitations for uses related*

Soil	Disposal of sewage effluent (onsite)[1]	Foundations for dwellings—		Lawns and landscaping	Local roads
		With basements	Without basements		
Birdsboro silt loam, 0 to 2 percent slopes: BdA.	Slight: stream pollution hazard.	Slight	Slight	Slight	Moderate: frost-action potential.
Birdsboro silt loam, 2 to 6 percent slopes: BdB.	Slight: stream pollution hazard.	Slight	Slight	Slight	Moderate: frost-action potential.
Birdsboro silt loam, 6 to 12 percent slopes, eroded: BdC2.	Moderate: strong slopes; special design needed.	Slight	Slight	Moderate: strong slopes.	Moderate: strong slopes; frost-action potential.
Bowmansville silt loam: Bt.	Severe: flooding	Severe: flooding	Severe: flooding	Severe: flooding	Severe: flooding
Bucks silt loam, 2 to 6 percent slopes: BuB.	Moderate: bedrock generally at a depth of 4 to 6 feet; moderately slow permeability.	Slight: rippable bedrock at a depth of 4 to 6 feet.	Slight	Slight	Moderate: frost-action potential.
Bucks silt loam, 6 to 12 percent slopes, eroded: BuC2.	Moderate: bedrock generally at a depth of 3½ to 5 feet; moderately slow permeability.	Slight: rippable bedrock at a depth of 3½ to 5 feet.	Slight	Moderate: strong slopes.	Moderate: frost-action potential.
Califon loam, 0 to 3 percent slopes: CaA.	Moderate: slow permeability; seasonal high water at a depth of ½ to 2½ feet; lateral seepage over pan; deep ditches needed in places.	Moderate: seasonal high water perched over pan; lateral seepage over pan.	Moderate: seasonal high water perched over pan.	Moderate: seasonal high water perched at a depth of ½ to 2½ feet.	Severe: high frost-action potential; seasonal high water perched over pan.
Califon loam, 3 to 8 percent slopes: CaB.	Moderate: slow permeability; seasonal high water at a depth of ½ to 2½ feet; lateral seepage over pan; deep ditches needed in places.	Moderate: seasonal high water perched over pan; lateral seepage over pan.	Moderate: seasonal high water perched over pan.	Moderate: seasonal high water perched at a depth of ½ to 2½ feet.	Severe: high frost-action potential; seasonal high water perched over pan.
Califon very stony loam, 0 to 8 percent slopes: CbB.	Severe: slow permeability; seasonal high water at a depth of ½ to 2½ feet; lateral seepage over pan; high stone content.	Severe: seasonal high water perched over the pan; lateral seepage over pan; high stone content.	Moderate: seasonal high water perched over pan; high stone content.	Severe: high stone content.	Severe: high frost-action potential; seasonal high water perched over pan; high stone content.
Chalfont silt loam, 0 to 2 percent slopes: CdA.	Severe: seasonal high water at a depth of ½ to 1½ feet.	Severe: seasonal high water at a depth of ½ to 1½ feet.	Moderate: seasonal high water at a depth of ½ to 1½ feet.	Moderate: seasonal high water at a depth of ½ to 1½ feet.	Severe: seasonal high water at a depth of ½ to 1½ feet; high frost-action potential.

See footnote at end of table.

to town and country planning—Continued

Parking lots	Athletic fields	Picnic areas	Campsites (trailers and tents)	Sanitary landfill [1]	Cemeteries
Moderate: frost-action potential.	Slight	Slight	Slight	Severe: rapid permeability of gravel bed is pollution hazard.	Slight.
Moderate: frost-action potential.	Moderate: slopes	Slight	Slight	Severe: rapid permeability of gravel bed is pollution hazard.	Slight.
Severe: strong slopes; frost-action potential.	Severe: strong slopes.	Moderate: strong slopes.	Moderate: strong slopes.	Severe: rapid permeability of gravel bed is pollution hazard.	Slight.
Severe: flooding	Severe: flooding	Severe: flooding	Severe: flooding	Severe: flooding	Severe: flooding.
Moderate: frost-action potential.	Moderate: gentle slopes.	Slight	Slight	Severe: rippable bedrock generally at a depth of 4 to 6 feet.	Moderate: rippable bedrock at a depth of 4 to 6 feet.
Severe: frost-action potential; strong slopes.	Severe: strong slopes.	Moderate: strong slopes.	Moderate: strong slopes.	Severe: rippable bedrock generally at a depth of 3½ to 5 feet.	Moderate: rippable bedrock at a depth of 3½ to 5 feet.
Severe: high frost-action potential; seasonal high water perched over pan.	Severe: seasonal high water at a depth of ½ to 2½ feet.	Slight: water level below a depth of 20 inches in picnic season.	Moderate: water at a depth below 20 inches in season of use.	Moderate: seasonal high water perched over pan; lateral seepage.	Moderate: seasonal high water perched over pan; lateral seepage.
Severe: high frost-action potential; seasonal high water perched over pan.	Severe: seasonal high water at a depth of ½ to 2½ feet.	Slight: water level below a depth of 20 inches in picnic season.	Moderate: water at a depth below 20 inches in season of use.	Moderate: seasonal high water perched over pan; lateral seepage.	Moderate: seasonal high water perched over pan; lateral seepage.
Severe: high frost-action potential; seasonal high water perched over pan; high stone content.	Severe: seasonal high water at a depth of ½ to 2½ feet; high stone content.	Moderate: high stone content.	Severe: high stone content.	Severe: high stone content.	Severe: high stone content.
Severe: seasonal high water at a depth of ½ to 1½ feet; high frost-action potential.	Severe: seasonal high water at a depth of ½ to 1½ feet.	Moderate: water level below a depth of 20 inches in picnic season.	Moderate: water level below a depth of 30 inches in camping season.	Severe: seasonal high water at a depth of ½ to 1½ feet; bedrock at a depth of 3½ to 6 feet.	Severe: seasonal high water at a depth of ½ to 1½ feet; bedrock at a depth of 3½ to 6 feet.

TABLE 10.—*Limitations for uses related*

Soil	Disposal of sewage effluent (onsite)[1]	Foundations for dwellings—		Lawns and landscaping	Local roads
		With basements	Without basements		
Chalfont silt loam, 2 to 6 percent slopes: CdB.	Severe: seasonal high water at a depth of ½ to 1½ feet.	Severe: seasonal high water at a depth of ½ to 1½ feet.	Moderate: seasonal high water at a depth of ½ to 1½ feet.	Moderate: seasonal high water at a depth of ½ to 1½ feet.	Severe: seasonal high water at a depth of ½ to 1½ feet; high frost-action potential.
Chalfont silt loam, 6 to 12 percent slopes, eroded: CdC2.	Severe: seasonal high water at a depth of ½ to 1½ feet.	Severe: seasonal high water at a depth of ½ to 1½ feet.	Moderate: seasonal high water at a depth of ½ to 1½ feet; strong slopes.	Moderate: seasonal high water at a depth of ½ to 1½ feet; strong slopes.	Severe: seasonal high water at a depth of ½ to 1½ feet; high frost-action potential.
Chalfont very stony silt loam, 2 to 12 percent slopes: CeB.	Severe: seasonal high water at a depth of ½ to 1½ feet; high stone content.	Severe: seasonal high water at a depth of ½ to 1½ feet; high stone content.	Moderate: seasonal high water at a depth of ½ to 1½ feet; high stone content.	Severe: high stone content.	Severe: seasonal high water at a depth of ½ to 1½ feet; high frost-action potential; high stone content.
Chalfont-Lehigh very stony silt loam, 2 to 12 percent slopes: CfC.					
Chalfont	Severe: seasonal high water at a depth of ½ to 1½ feet; high stone content.	Severe: seasonal high water at a depth of ½ to 1½ feet; high stone content.	Moderate: seasonal high water at a depth of ½ to 1½ feet; high stone content.	Severe: high stone content.	Severe: seasonal high water at a depth of ½ to 1½ feet; high frost-action potential; high stone content.
Lehigh	Severe: shale bedrock at a depth of 3½ to 5 feet; seasonal high water table at a depth of ½ to 2 feet; very stony.	Severe: seasonal high water table at a depth of ½ to 2 feet; rippable shale bedrock at a depth of 3½ to 5 feet; very stony.	Moderate: seasonal high water table at a depth of ½ to 2 feet; very stony.	Severe: very stony.	Severe: seasonal high water table at a depth of ½ to 2 feet; very stony.
Chalfont-Quakertown silt loams, 0 to 6 percent slopes: CgB.					
Chalfont	Severe: seasonal high water at a depth of ½ to 1½ feet.	Severe: seasonal high water at a depth of ½ to 1½ feet.	Moderate: seasonal high water at a depth of ½ to 1½ feet.	Moderate: seasonal high water at a depth of ½ to 1½ feet.	Severe: seasonal high water at a depth of ½ to 1½ feet; high frost-action potential.
Quakertown	Moderate: bedrock generally at a depth of 4 to 6 feet.	Slight: rippable bedrock generally at a depth of 4 to 6 feet.	Slight	Slight	Moderate: frost-action potential.
Cokesbury loam: Co	Severe: seasonal high water at a depth of 0 to 1 foot.	Severe: seasonal high water at a depth of 0 to 1 foot.	Severe: seasonal high water at a depth of 0 to 1 foot.	Severe: seasonal high water at a depth of 0 to 1 foot.	Severe: seasonal high water at a depth of 0 to 1 foot.
Cokesbury very stony loam: Cp.	Severe: seasonal high water at a depth of 0 to 1 foot; high stone content.	Severe: seasonal high water at a depth of 0 to 1 foot; high stone content.	Severe: seasonal high water at a depth of 0 to 1 foot; high stone content.	Severe: seasonal high water at a depth of 0 to 1 foot; high stone content.	Severe: seasonal high water at a depth of 0 to 1 foot; high stone content.

See footnote at end of table.

to town and country planning—Continued

Parking lots	Athletic fields	Picnic areas	Campsites (trailers and tents)	Sanitary landfill [1]	Cemeteries
Severe: seasonal high water at a depth of ½ to 1½ feet; high frost-action potential.	Severe: seasonal high water at a depth of ½ to 1½ feet.	Moderate: water level below a depth of 20 inches in picnic season.	Moderate: water level below a depth of 30 inches in camping season.	Severe: seasonal high water at a depth of ½ to 1½ feet; bedrock at a depth of 3½ to 6 feet.	Severe: seasonal high water at a depth of ½ to 1½ feet; bedrock at a depth of 3½ to 6 feet.
Severe: seasonal high water at a depth of ½ to 1½ feet; high frost-action potential; strong slopes.	Severe: seasonal high water at a depth of ½ to 1½ feet; strong slopes.	Moderate: water level below a depth of 20 inches in picnic season.	Moderate: water level below a depth of 30 inches in camping season.	Severe: seasonal high water at a depth of ½ to 1½ feet; bedrock at a depth of 3½ to 6 feet.	Severe: seasonal high water at a depth of ½ to 1½ feet; bedrock at a depth of 3½ to 6 feet.
Severe: seasonal high water at a depth of ½ to 1½ feet; high frost-action potential; high stone content.	Severe: high stone content.	Moderate: water level below a depth of 20 inches in picnic season; high stone content.	Severe: high stone content.	Severe: seasonal high water at a depth of ½ to 1½ feet; bedrock at a depth of 3½ to 6 feet; high stone content.	Severe: seasonal high water at a depth of ½ to 1½ feet; bedrock at a depth of 3½ to 6 feet; high stone content.
Severe: seasonal high water at a depth of ½ to 1½ feet; high frost-action potential; high stone content.	Severe: high stone content.	Moderate: water level below a depth of 20 inches in picnic season; high stone content.	Severe: high stone content.	Severe: seasonal high water at a depth of ½ to 1½ feet; bedrock at a depth of 3½ to 6 feet; high stone content.	Severe: seasonal high water at a depth of ½ to 1½ feet; bedrock at a depth of 3½ to 6 feet; high stone content.
Severe: seasonal high water table at a depth of ½ to 2 feet; very stony.	Severe: very stony.	Moderate: very stony.	Severe: very stony.	Severe: bedrock at a depth of 3½ to 5 feet; very stony.	Severe: seasonal high water table at a depth of ½ to 2 feet; rippable bedrock at 3½ to 5 feet; very stony.
Severe: seasonal high water at a depth of ½ to 1½ feet; high frost-action potential.	Severe: seasonal high water at a depth of ½ to 1½ feet.	Moderate: water level below a depth of 20 inches in picnic season.	Moderate: water level below a depth of 30 inches in camping season.	Severe: seasonal high water at a depth of ½ to 1½ feet; bedrock at a depth of 3½ to 6 feet.	Severe: seasonal high water at a depth of ½ to 1½ feet; bedrock at a depth of 3½ to 6 feet
Moderate: frost-action potential.	Moderate: gentle slopes.	Slight	Slight	Severe: rippable bedrock at a depth of 4 to 6 feet.	Slight: rippable bedrock at a depth of 4 to 6 feet.
Severe: seasonal high water at a depth of 0 to 1 foot.	Severe: seasonal high water at a depth of 0 to 1 foot.	Severe: seasonal high water at a depth of 0 to 1 foot.	Severe: seasonal high water at a depth of 0 to 1 foot.	Severe: seasonal high water at a depth of 0 to 1 foot.	Severe: seasonal high water at a depth of 0 to 1 foot.
Severe: seasonal high water at a depth of 0 to 1 foot; high stone content.	Severe: seasonal high water at a depth of 0 to 1 foot; high stone content.	Severe: seasonal high water at a depth of 0 to 1 foot; high stone content.	Severe: seasonal high water at a depth of 0 to 1 foot; high stone content.	Severe: seasonal high water at a depth of 0 to 1 foot; high stone content.	Severe: seasonal high water at a depth of 0 to 1 foot; high stone content.

TABLE 10.—*Limitations for uses related*

Soil	Disposal of sewage effluent (onsite)[1]	Foundations for dwellings—		Lawns and landscaping	Local roads
		With basements	Without basements		
Croton silt loam, 0 to 2 percent slopes: CrA.	Severe: seasonal high water at a depth of 0 to 1 foot.	Severe: seasonal high water at a depth of 0 to 1 foot.	Severe: seasonal high water at a depth of 0 to 1 foot.	Severe: seasonal high water at a depth of 0 to 1 foot.	Severe: seasonal high water at a depth of 0 to 1 foot.
Croton silt loam, 2 to 6 percent slopes: CrB.	Severe: seasonal high water at a depth of 0 to 1 foot.	Severe: seasonal high water at a depth of 0 to 1 foot.	Severe: seasonal high water at a depth of 0 to 1 foot.	Severe: seasonal high water at a depth of 0 to 1 foot.	Severe: seasonal high water at a depth of 0 to 1 foot.
Croton very stony silt loam, 0 to 6 percent slopes: CsB.	Severe: seasonal high water at a depth of 0 to 1 foot; high stone content.	Severe: seasonal high water at a depth of 0 to 1 foot; high stone content.	Severe: seasonal high water at a depth of 0 to 1 foot; high stone content.	Severe: seasonal high water at a depth of 0 to 1 foot; high stone content.	Severe: seasonal high water at a depth of 0 to 1 foot; high stone content.
Duffield silt loam, 2 to 6 percent slopes: DuB.	Slight: pollution hazard where bedrock is cavernous.	Slight: bedrock is cavernous in in places.	Slight	Slight	Moderate: frost-action potential.
Duffield silt loam, 6 to 12 percent slopes, eroded: DuC2.	Slight: pollution hazard where bedrock is cavernous.	Slight: bedrock is cavernous in places.	Slight	Moderate: strong slopes.	Moderate: frost-action potential.
Duffield rocky silt loam, 6 to 12 percent slopes, eroded: DvC2.	Severe: pollution hazard where bedrock is cavernous; rock outcrops may cause special designs of disposal systems.	Moderate: rock outcrops.	Moderate: rock outcrops	Moderate: rock outcrops.	Moderate: rock outcrops.
Duffield very rocky silt loam, 12 to 18 percent slopes, eroded: DwD2.	Severe: rock outcrops control design.	Severe: rock outcrops control dwelling locations.	Severe: rock outcrops control dwelling locations.	Severe: many rock outcrops.	Severe: many rock outcrops.
Edneyville gravelly loam, 3 to 8 percent slopes: EdB.	Moderate: hard bedrock normally at a depth of 3½ to 6 feet.	Moderate: hard bedrock at a depth of 3½ to 6 feet.	Slight	Moderate: gravel content exceeds 20 percent in most places.	Moderate: frost-action potential.
Edneyville gravelly loam, 8 to 15 percent slopes, eroded: EdC2.	Moderate: hard bedrock normally at a depth of 3½ to 6 feet.	Moderate: hard bedrock at a depth of 3½ to 6 feet.	Moderate: strong slopes.	Moderate: gravel content exceeds 20 percent in most places; strong slopes.	Moderate: frost-action potential; strong slopes.
Edneyville gravelly loam, 15 to 25 percent slopes: EdD.	Severe: moderately steep slopes.	Severe: moderately steep slopes.	Severe: moderately steep slopes.	Severe: moderately steep slopes.	Severe: moderately steep slopes.

See footnote at end of table.

to town and country planning—Continued

Parking lots	Athletic fields	Picnic areas	Campsites (trailers and tents)	Sanitary landfill [1]	Cemeteries
Severe: seasonal high water at a depth of 0 to 1 foot.	Severe: seasonal high water at a depth of 0 to 1 foot.	Severe: seasonal high water at a depth of 0 to 1 foot.	Severe: seasonal high water at a depth of 0 to 1 foot.	Severe: seasonal high water at a depth of 0 to 1 foot.	Severe: seasonal high water at a depth of 0 to 1 foot.
Severe: seasonal high water at a depth of 0 to 1 foot.	Severe: seasonal high water at a depth of 0 to 1 foot.	Severe: seasonal high water at a depth of 0 to 1 foot.	Severe: seasonal high water at a depth of 0 to 1 foot.	Severe: seasonal high water at a depth of 0 to 1 foot.	Severe: seasonal high water at a depth of 0 to 1 foot.
Severe: seasonal high water at a depth of 0 to 1 foot; high stone content.	Severe: seasonal high water at a depth of 0 to 1 foot; high stone content.	Severe: seasonal high water at a depth of 0 to 1 foot; high stone content.	Severe: seasonal high water at a depth of 0 to 1 foot; high stone content.	Severe: seasonal high water at a depth of 0 to 1 foot; high stone content.	Severe: seasonal high water at a depth of 0 to 1 foot; high stone content.
Moderate: frost-action potential.	Moderate: gentle slopes.	Slight	Slight	Slight where bedrock is below a depth of 8 feet feet and not cavernous. Severe where bedrock is cavernous or at a depth of less than 6 feet.	Slight.
Severe: strong slopes.	Severe: strong slopes.	Moderate: strong slopes.	Moderate: strong slopes.	Slight where bedrock is below a depth of 8 feet and not cavernous. Severe where bedrock is cavernous or at a depth of less than 6 feet.	Slight.
Moderate: rock outcrops.	Severe: rock outcrops.	Moderate: rock outcrops.	Moderate: rock outcrops.	Moderate: rock outcrops.	Moderate: rock outcrops.
Severe: many rock outcrops.	Severe: many rock outcrops.	Severe: many rock outcrops.	Severe: many rock outcrops.	Severe: many rock outcrops.	Severe: many rock outcrops.
Moderate: frost-action potential; gentle slopes.	Severe: gravel content exceeds 20 percent in most places.	Slight	Slight	Severe: hard bedrock at a depth of 3½ to 6 feet.	Severe: hard bedrock at a depth of 3½ to 6 feet.
Severe: strong slopes.	Severe: strong slopes; gravel content exceeds 20 percent in most places.	Moderate: strong slopes.	Moderate: strong slopes.	Severe: hard bedrock at a depth of 3½ to 6 feet.	Severe: hard bedrock at a depth of 3½ to 6 feet.
Severe: moderately steep slopes.	Severe: moderately steep slopes.	Severe: moderately steep slopes.	Severe: moderately steep slopes.	Severe: moderately steep slopes; hard bedrock at a depth of 3½ to 6 feet.	Severe: hard bedrock at a depth of 3½ to 6 feet; moderately steep slopes.

TABLE 10.—*Limitations for uses related*

Soil	Disposal of sewage effluent (onsite)[1]	Foundations for dwellings—		Lawns and landscaping	Local roads
		With basements	Without basements		
Edneyville and Parker extremely stony loams, 3 to 15 percent slopes: EeC.	Severe: extremely stony.	Moderate: extremely stony.	Moderate: extremely stony.	Severe: extremely stony.	Severe: extremely stony.
Hazleton channery loam, 2 to 6 percent slopes: HaB.	Moderate: rippable bedrock at a depth of 4 to 6 feet.	Slight: rippable shale bedrock at a depth of 4 to 6 feet.	Slight	Moderate: shale fragment content exceeds 20 percent in surface layer.	Moderate: frost action potential.
Hazleton channery loam, 6 to 12 percent slopes, eroded: HaC2.	Moderate: rippable bedrock at a depth of 4 to 5 feet.	Slight: rippable shale bedrock at a depth of 4 to 5 feet.	Slight	Moderate: shale fragment content exceeds 20 percent in surface layer; strong slopes.	Moderate: frost action potential; strong slopes.
Hazleton channery loam, 12 to 18 percent slopes: HaD.	Severe: moderately steep slopes.	Moderate: moderately steep slopes.	Moderate: moderately steep slopes.	Severe: moderately steep slopes.	Severe: moderately steep slopes.
Hazleton very stony loam, 6 to 18 percent slopes: HcC.	Severe: excessive stones.	Moderate: excessive stones; moderately steep slopes.	Moderate: excessive stones; moderately steep slopes.	Severe: excessive stones.	Severe: moderately steep slopes; excessive stones.
Hazleton very stony loam, 18 to 40 percent slopes: HcE.	Severe: steep slopes; excessive stones.	Severe: steep slopes; excessive stones.	Severe: steep slopes; excessive stones.	Severe: steep slopes; excessive stones.	Severe: steep slopes; excessive stones.
Klinesville shaly loam, 4 to 12 percent slopes: KlC.	Severe: pervious shale bedrock at a depth of 1 to 1½ feet.	Severe: rippable shale bedrock at a depth of 1 to 1½ feet.	Moderate: rippable shale bedrock at a depth of 1 to 1½ feet.	Severe: bedrock at a depth of less than 1½ feet.	Severe: bedrock at a depth of less than 1½ feet.
Klinesville shaly loam, 12 to 18 percent slopes: KlD.	Severe: pervious shale bedrock at a depth of 1 to 1½ feet, moderately steep slopes.	Severe: rippable shale bedrock at a depth of 1 to 1½ feet; moderately steep slopes.	Moderate: rippable shale bedrock at a depth of 1 to 1½ feet; moderately steep slopes.	Severe: bedrock at a depth of less than 1½ feet.	Severe: bedrock at a depth of less than 1½ feet.
Lansdale loam, 0 to 6 percent slopes: LaB.	Moderate: bedrock generally at a depth of 4 to 5 feet.	Slight: rippable bedrock at a depth of 4 to 5 feet.	Slight	Slight	Moderate: frost-action potential.
Lansdale loam, 6 to 12 percent slopes, eroded: LaC2.	Moderate: bedrock generally at a depth of 4 to 5 feet.	Slight: rippable bedrock at a depth of 4 to 5 feet.	Slight	Moderate: strong slopes.	Moderate: frost-action potential.
Lansdale loam, 12 to 18 percent slopes: LaD.	Severe: moderately steep slopes.	Moderate: moderately steep slopes.	Moderate: moderately steep slopes.	Severe: moderately steep slopes.	Severe: moderately steep slopes.

See footnote at end of table.

to town and country planning—Continued

Parking lots	Athletic fields	Picnic areas	Campsites (trailers and tents)	Sanitary landfill [1]	Cemeteries
Severe: extremely stony.	Severe: extremely stony.	Severe: extremely stony.	Severe: extremely stony.	Severe: extremely stony; hard bedrock at a depth of 3½ to 6 feet.	Severe: extremely stony; hard bedrock at a depth of 3½ to 6 feet.
Moderate: frost-action potential.	Moderate: gentle slopes; excessive shale fragments.	Slight	Slight	Severe: rippable shale bedrock at a depth of 4 to 6 feet.	Moderate: rippable shale bedrock at a depth of 4 to 6 feet.
Severe: strong slopes.	Severe: strong slopes.	Moderate: strong slopes.	Moderate: strong slopes.	Severe: rippable shale bedrock at a depth of 4 to 5 feet.	Moderate: rippable shale bedrock at a depth of 4 to 5 feet.
Severe: moderately steep slopes.	Severe: moderately steep slopes.	Severe: moderately steep slopes.	Severe: moderately steep slopes.	Severe: rippable shale bedrock at a depth of 4 to 5 feet; moderately steep slopes.	Moderate: rippable shale bedrock at a depth of 4 to 5 feet; moderately steep slopes.
Severe: moderately steep slopes; excessive stones.	Severe: moderately steep slopes; excessive stones.	Severe: moderately steep slopes.	Severe: moderately steep slopes; excessive stones.	Severe: rippable shale bedrock at a depth of 4 to 5 feet; moderately steep slopes; excessive stones.	Severe: excessive stones; rippable shale bedrock at a depth of 4 to 5 feet; moderately steep slopes.
Severe: steep slopes; excessive stones.	Severe: steep slopes; excessive stones.	Severe: steep slopes; excessive stones.	Severe: steep slopes; excessive stones.	Severe: steep slopes; excessive stones; bedrock at a depth of 4 to 5 feet.	Severe: bedrock at a depth of 4 to 5 feet; excessive stones.
Severe: bedrock at a depth of less than 1½ feet.	Severe: bedrock at a depth of less than 1½ feet.	Moderate: strong slopes.	Moderate: strong slopes.	Severe: bedrock at a depth of less than 1½ feet.	Severe: bedrock at a depth of less than 1½ feet.
Severe: bedrock at a depth of less than 1½ feet.	Severe: bedrock at a depth of less than 1½ feet.	Severe: moderately steep slopes.	Severe: moderately steep slopes.	Severe: bedrock at a depth of less than 1½ feet.	Severe: bedrock at a depth of less than 1½ feet.
Moderate: frost-action potential.	Moderate: gentle slopes.	Slight	Slight	Severe: rippable bedrock at a depth of 4 to 5 feet.	Moderate: rippable bedrock at a depth of 4 to 5 feet.
Severe: strong slopes.	Severe: strong slopes.	Moderate: strong slopes.	Moderate: strong slopes.	Severe: rippable bedrock at a depth of 4 to 5 feet.	Moderate: rippable bedrock at a depth of 4 to 5 feet.
Severe: moderately steep slopes.	Severe: moderately steep slopes.	Severe: moderately steep slopes.	Severe: moderately steep slopes.	Severe: moderately steep slopes.	Moderate: rippable bedrock at a depth of 4 to 5 feet.

TABLE 10.—*Limitations for uses related*

Soil	Disposal of sewage effluent (onsite)[1]	Foundations for dwellings—		Lawns and landscaping	Local roads
		With basements	Without basements		
Lansdowne silt loam, 0 to 6 percent slopes: LbB.	Severe: seasonal high water at a depth of 1 to 2½ feet.	Severe: seasonal high water at a depth of 1 to 2½ feet.	Moderate: seasonal high water at a depth of 1 to 2½ feet.	Moderate: seasonal high water at a depth of 1 to 2½ feet.	Severe: seasonal high water at a depth of 1 to 2½ feet; high frost-action potential.
Lawrenceville silt loam, 2 to 6 percent slopes: LeB.	Moderate: seasonal high water perched at a depth of 1½ to 3 feet; bedrock at a depth of 4 to 6 feet.	Moderate: seasonal high water perched at a depth of 1½ to 3 feet.	Slight	Slight: seasonal high water at a depth of 1½ to 3 feet.	Severe: seasonal high water at a depth of 1½ to 3 feet; high frost-action potential.
Lawrenceville silt loam, 6 to 12 percent slopes, eroded: LeC2.	Moderate: seasonal high water perched at a depth of 1½ to 3 feet.	Moderate: seasonal high water perched at a depth of 1½ to 3 feet.	Slight	Moderate: strong slopes.	Severe: seasonal high water at a depth of 1½ to 3 feet; high frost-action potential.
Legore gravelly loam, 2 to 6 percent slopes: LgB.	Slight: bedrock at a depth of less than 6 feet in places.	Slight	Slight	Moderate: gravel content exceeds 20 percent of surface layer.	Moderate: frost-action potential.
Legore gravelly loam, 6 to 12 percent slopes: LgC.	Moderate: bedrock at a depth of 5 to 6 feet.	Slight	Slight	Moderate: strong slopes; excessive gravel content in surface layer.	Moderate: strong slopes; high frost-action potential.
Legore gravelly loam, 12 to 18 percent slopes: LgD.	Severe: moderately steep slopes.	Severe: moderately steep slopes.	Severe: moderately steep slopes.	Severe: moderately steep slopes.	Severe: moderately steep slopes.
Lehigh silt loam, 2 to 6 percent slopes: LhB.	Severe: shale bedrock at a depth of 3½ to 5 feet; seasonal high water table at a a depth of ½ to 2 feet.	Moderate: seasonal high water table at a depth of ½ to 2 feet; rippable shale bedrock at a depth of 3½ to 5 feet.	Moderate: seasonal high water table at a depth of ½ to 2 feet.	Moderate: seasonal high water table at a depth of ½ to 2 feet.	Severe: seasonal high water table at a depth of ½ to 2 feet; high frost-action potential.
Lehigh silt loam, 6 to 12 percent slopes, eroded: LhC2.	Severe: shale bedrock at a depth of 3½ to 5 feet; seasonal high water table at a depth of ½ to 2 feet.	Moderate: seasonal high water table at a depth of ½ to 2 feet; rippable shale bedrock at a depth of 3½ to 5 feet.	Moderate: seasonal high water table at a depth of ½ to 2 feet.	Moderate: seasonal high water table at at a depth of ½ to 2 feet; strong slopes.	Severe: seasonal high water table at a depth of ½ to 2 feet; strong slopes; high frost-action potential.
Lehigh silt loam, 12 to 18 percent slopes, eroded: LhD2.	Severe: shale bedrock at a depth of 3½ to 5 feet; seasonal high water table at a depth of ½ to 2 feet.	Moderate: moderately steep slopes	Moderate: moderately steep slopes.	Severe: moderately steep slopes.	Severe: moderately steep slopes.

See footnote at end of table.

to town and country planning—Continued

Parking lots	Athletic fields	Picnic areas	Campsites (trailers and tents)	Sanitary landfill [1]	Cemeteries
Severe: seasonal high water at a depth of 1 to 2½ feet; high frost-action potential.	Severe: seasonal high water at a depth of 1 to 2½ feet.	Slight: water below a depth of 20 inches in picnic season.	Moderate: water below a depth of 20 inches in camping season.	Severe: bedrock at a depth of 3½ to 5 feet.	Severe: seasonal high water at a depth of 1 to 2½ feet.
Severe: seasonal high water at a depth of 1½ to 3 feet; high frost-action potential.	Moderate: seasonal high water at a depth of 1½ to 3 feet.	Slight	Slight	Severe: rippable bedrock at a depth of 4 to 6 feet.	Severe: seasonal high water at a depth of 1½ to 3 feet; rippable bedrock at a depth of 3½ to 5 feet.
Severe: seasonal high water at a depth of 1½ to 3 feet; high frost-action potential.	Severe: strong slopes.	Moderate: strong slopes.	Moderate: strong slopes.	Severe: rippable bedrock at a depth of 3½ to 5 feet.	Severe: seasonal high water at a depth of 1½ to 3 feet; rippable bedrock at a depth of 3½ to 5 feet.
Moderate: frost-action potential.	Severe: excessive coarse fragment content in surface layer.	Slight	Slight	Moderate where bedrock is at a depth of more than 6 feet. Severe where bedrock is at a depth of less than 6 feet.	Slight.
Severe: strong slopes.	Severe: strong slopes.	Moderate: strong slopes.	Moderate: strong slopes.	Severe: bedrock normally at a depth of less than 6 feet.	Slight.
Severe: moderately steep slopes.	Severe: moderately steep slopes.	Severe: moderately steep slopes.	Severe: moderately steep slopes.	Severe: bedrock normally at a depth of less than 6 feet; moderately steep slopes.	Slight.
Severe: seasonal high water table at a depth of ½ to 2 feet; high frost-action potential.	Severe: seasonal high water table at a depth of ½ to 2 feet.	Slight: water table below a depth of 20 inches in picnic season.	Slight: water table below a depth of 20 inches in camping season.	Severe: bedrock at a depth of 3½ to 5 feet.	Severe: seasonal high water table at a depth of ½ to 2 feet; rippable bedrock at a depth of 3½ to 5 feet.
Severe: seasonal high water table at a depth of ½ to 2 feet; high frost-action potential; strong slopes.	Severe: seasonal high water table at a depth of ½ to 2 feet; strong slopes.	Moderate: strong slopes.	Moderate: strong slopes.	Severe: bedrock at a depth of 3½ to 5 feet.	Severe: seasonal high water table at a depth of ½ to 2 feet; rippable bedrock at a depth of 3½ to 5 feet.
Severe: moderately steep slopes.	Severe: moderately steep slopes.	Severe: moderately steep slopes.	Severe: moderately steep slopes.	Severe: bedrock at a depth of 3½ to 5 feet; moderately steep slopes.	Severe: seasonal high water table at a depth of ½ to 2 feet; rippable bedrock at a depth of 3½ to 5 feet.

TABLE 10.—*Limitations for uses related*

Soil	Disposal of sewage effluent (onsite)[1]	Foundations for dwellings—		Lawns and landscaping	Local roads
		With basements	Without basements		
Lehigh very stony silt loam, 2 to 6 percent slopes: LkB.	Severe: shale bedrock at a depth of 3½ to 5 feet; seasonal high water table at a depth of ½ to 2 feet; very stony.	Severe: seasonal high water table at a depth of ½ to 2 feet; rippable shale bedrock at a depth of 3½ to 5 feet; very stony.	Moderate: seasonal high water table at a depth of ½ to 2 feet; very stony.	Severe: very stony.	Severe: seasonal high water table at a depth of ½ to 2 feet; very stony.
Lehigh very stony silt loam, 6 to 18 percent slopes: LkC.	Severe: shale bedrock at a depth of 3½ to 5 feet; seasonal high water table at a depth of ½ to 2 feet; very stony.	Severe: seasonal high water table at a depth of ½ to 2 feet; rippable shale bedrock at a depth of 3½ to 5 feet; very stony.	Moderate: seasonal high water table at a depth of ½ to 2 feet; very stony.	Severe: very stony.	Severe: seasonal high water table at a depth of ½ to 2 feet; very stony.
Made land: Ma	Severe: trash obstruction.	Severe: uneven settling, gas formation likely.	Moderate: uneven settling, gas formation likely.	Moderate: uneven settling.	Moderate to severe: uneven settling; grading restrictions.
Meckesville gravelly loam, 2 to 6 percent slopes: MeB.	Moderate: deep trenches may be needed.	Slight	Slight	Slight: gravel content less than 20 percent.	Moderate: frost-action potential.
Meckesville gravelly loam, 6 to 12 percent slopes, eroded: MeC2.	Moderate: deep trenches may be needed.	Slight	Slight	Moderate: strong slopes.	Moderate: frost-action potential.
Mount Lucas silt loam, 0 to 6 percent slopes: MoB.	Severe: seasonal high water table at a depth of ½ to 2½ feet; hard bedrock at a depth of 4 to more than 8 feet.	Moderate: seasonal high water table at a depth of ½ to 2½ feet; hard bedrock at a depth of 4 to more than 8 feet.	Moderate: seasonal high water table at a depth of ½ to 2½ feet.	Slight	Severe: seasonal high water table at a depth of ½ to 2½ feet; high frost-action potential.
Mount Lucas-Watchung very stony silt loams, 0 to 6 percent slopes: MwB.	Severe: seasonal high water table at a depth of 0 to 2½ feet; hard bedrock at a depth of 4 to more than 8 feet; very stony.	Severe: seasonal high water table at a depth of 0 to 2½ feet; hard bedrock at a depth of 4 to more than 8 feet; very stony.	Severe: seasonal high water table at a depth of 0 to 2½ feet; very stony.	Severe: very stony.	Severe: very stony.
Neshaminy gravelly loam, 2 to 6 percent slopes: NdB.	Slight: bedrock at a depth of less than 6 feet in places.	Slight: bedrock at a depth of less than 6 feet in places.	Slight	Slight: gravel in places.	Moderate: frost-action potential.
Neshaminy silt loam, 2 to 6 percent slopes: NeB.	Slight: bedrock at a depth of less than 6 feet in places.	Slight: bedrock at a depth of less than 6 feet in places.	Slight	Slight	Moderate: frost-action potential.
Neshaminy silt loam, 6 to 12 percent slopes, eroded: NeC2.	Moderate: bedrock generally at a depth of 4 to 6 feet.	Moderate: bedrock generally at a depth of 4 to 6 feet.	Slight	Moderate: strong slopes.	Moderate: frost-action potential.

See footnote at end of table.

to town and country planning—Continued

Parking lots	Athletic fields	Picnic areas	Campsites (trailers and tents)	Sanitary landfill [1]	Cemeteries
Severe: seasonal high water table at a depth of ½ to 2 feet; very stony.	Severe: very stony.	Moderate: very stony.	Severe: very stony.	Severe: bedrock at a depth of 3½ to 5 feet; very stony.	Severe: seasonal high water table at a depth of ½ to 2 feet; rippable bedrock at a depth of 3½ to 5 feet; very stony.
Severe: seasonal high water table at a depth of ½ to 2 feet; very stony.	Severe: very stony.	Moderate: very stony.	Severe: very stony.	Severe: bedrock at a depth of 3½ to 5 feet; very stony.	Severe: seasonal high water table at a depth of ½ to 2 feet; rippable bedrock at a depth of 3½ to 5 feet; very stony.
Severe: uneven settling; aeration needed.	Moderate: uneven settling; grading restrictions.	Slight	Slight	Severe: trash obstructions.	Severe: trash obstructions.
Moderate: frost-action potential.	Moderate: gentle slopes; moderate gravel content.	Slight	Slight	Moderate: rippable bedrock at a depth of 5 to 8 feet.	Slight.
Severe: strong slopes.	Severe: strong slopes.	Moderate: strong slopes.	Moderate: strong slopes.	Moderate: rippable bedrock at a depth of 5 to 8 feet.	Slight.
Severe: seasonal high water table at a depth of ½ to 2½ feet; high frost action potential.	Moderate: seasonal high water table at a depth of ½ to 2½ feet.	Slight: water table below a depth of 20 inches in picnic season.	Slight: water table below a depth of 20 inches in camping season.	Severe: hard bedrock at a depth of 4 to more than 8 feet; seasonal high water table at a depth of ½ to 2½ feet.	Severe: seasonal high water table at a depth of ½ to 2½ feet; hard bedrock at a depth of 4 to more than 8 feet.
Severe: very stony.	Severe: very stony.	Moderate: very stony.	Moderate: very stony.	Severe: hard bedrock at a depth of 4 to more than 8 feet; seasonal high water table at a depth of 0 to 2½ feet.	Severe: seasonal high water table at a depth of 0 to 2½ feet; hard bedrock at a depth of 4 to more than 8 feet; very stony.
Moderate: frost-action potential.	Moderate: gentle slopes; gravel excessive in places.	Slight	Slight	Moderate: hard bedrock at a depth of 4 to more than 8 feet.	Moderate: hard bedrock at a depth of 4 to more than 8 feet.
Moderate: frost-action potential.	Moderate: gentle slopes.	Slight	Slight	Moderate: hard bedrock at a depth of 4 to more than 8 feet.	Moderate: hard bedrock at a depth of 4 to more than 8 feet.
Severe: strong slopes.	Severe: strong slopes.	Moderate: strong slopes.	Moderate: strong slopes.	Moderate: hard bedrock at a depth of 4 to more than 8 feet.	Moderate: hard bedrock at a depth of 4 to more than 8 feet.

TABLE 10.—*Limitations for uses related*

Soil	Disposal of sewage effluent (onsite)[1]	Foundations for dwellings—		Lawns and landscaping	Local roads
		With basements	Without basements		
Neshaminy very stony silt loam, 2 to 12 percent slopes: NhC.	Severe: very stony.	Moderate: very stony.	Moderate: very stony.	Severe: very stony.	Severe: very stony.
Neshaminy very stony silt loam, 12 to 18 percent slopes: NhD.	Severe: very stony; moderately steep.	Severe: very stony; moderately steep.	Severe: very stony; moderately steep.	Severe: very stony; moderately steep.	Severe: very stony; moderately steep.
Neshaminy very stony silt loam, 18 to 40 percent slopes: NhE.	Severe: very stony; steep.	Severe: very stony; steep.	Severe: very stony; steep.	Severe: very stony; steep.	Severe: very stony; steep.
Neshaminy-Mount Lucas very stony silt loams, 2 to 12 percent slopes: NkC.					
Neshaminy	Severe: very stony.	Moderate: very stony.	Moderate: very stony.	Severe: very stony.	Severe: very stony.
Mount Lucas	Severe: seasonal high water table at a depth of ½ to 2½ feet; hard bedrock at a depth of 4 to more than 8 feet; very stony.	Severe: seasonal high water table at a depth of ½ to 2½ feet; hard bedrock at a depth of 4 to more than 8 feet; very stony.	Severe: seasonal high water table at a depth of ½ to 2½ feet; very stony.	Severe: very stony.	Severe: very stony.
Norton loam, 2 to 6 percent slopes: NoB.	Severe: slow permeability.	Moderate: rippable shale bedrock at a depth of 4 to more than 6 feet; slow permeability may perch water for short periods.	Slight	Slight	Moderate: frost-action potential.
Norton loam, 6 to 12 percent slopes, eroded: NoC2.	Severe: slow permeability.	Moderate: rippable shale bedrock at a depth of 4 to more than 6 feet; slow permeability may cause perched water for short periods.	Slight	Moderate: strong slopes.	Moderate: frost-action potential.
Norton loam, 12 to 18 percent slopes, eroded: NoD2.	Severe: slow permeability.	Moderate: rippable shale bedrock at a depth of 4 to more than 6 feet; slow permeability may cause a perched water table for short periods; moderately steep slopes.	Moderate: moderately steep slopes.	Severe: moderately steep slopes.	Severe: moderately steep slopes.
Parker cobbly loam, 3 to 15 percent slopes: PaC.	Moderate: bedrock generally at a depth of 3½ to 6 feet; some strong slopes.	Moderate: bedrock generally at a depth of 3½ to 6 feet; some strong slopes.	Slight	Moderate: excessive cobblestone content in surface layer; some strong slopes.	Moderate: frost-action potential; some strong slopes.

See footnote at end of table.

to town and country planning—Continued

Parking lots	Athletic fields	Picnic areas	Campsites (trailers and tents)	Sanitary landfill [1]	Cemeteries
Severe: very stony.	Severe: very stony.	Moderate: very stony.	Severe: very stony.	Severe: very stony.	Severe: very stony.
Severe: very stony; moderately steep.	Severe: very stony; moderately steep.	Severe: very stony; moderately steep.	Severe: very stony; moderately steep.	Severe: very stony; moderately steep.	Severe: very stony; moderately steep.
Severe: very stony; steep.	Severe: very stony; steep.	Severe: very stony; steep.	Severe: very stony; steep.	Severe: very stony; steep.	Severe: very stony; steep.
Severe: very stony.	Severe: very stony.	Moderate: very stony.	Severe: very stony.	Severe: very stony.	Severe: very stony.
Severe: very stony.	Severe: very stony.	Moderate: very stony.	Moderate: very stony.	Severe: hard bedrock at a depth of 4 to more than 8 feet; seasonal high water table at a depth of ½ to 2½ feet.	Severe: seasonal high water table at a depth of ½ to 2½ feet; hard bedrock at a depth of 4 to more than 8 feet; very stony.
Moderate: frost-action potential.	Moderate: gentle slopes.	Slight	Slight	Moderate where bedrock is at a depth of more than 6 feet. Severe where bedrock is at a depth of less than 6 feet.	Slight.
Severe: strong slopes.	Severe: strong slopes.	Moderate: strong slopes.	Moderate: strong slopes.	Severe: bedrock generally at a depth of less than 6 feet.	Slight.
Severe: moderately steep slopes.	Severe: moderately steep slopes.	Severe: moderately steep slopes.	Severe: moderately steep slopes.	Severe: rippable shale bedrock at a depth of 4 to more than 6 feet; moderately steep slopes.	Moderate: moderately steep slopes.
Moderate for slopes to 8 percent; severe for slopes of 8 to 15 percent.	Severe: excessive cobblestone content in surface layer.	Moderate: excessive cobblestone content in surface layer; some strong slopes.	Moderate: excessive cobblestone content in surface layer; some strong slopes.	Severe: low filter material; rapid permeability causes pollution hazard.	Severe: bedrock generally at a depth of 3½ to 6 feet; high stone content.

TABLE 10.—*Limitations for uses related*

Soil	Disposal of sewage effluent (onsite)[1]	Foundations for dwellings—		Lawns and landscaping	Local roads
		With basements	Without basements		
Parker cobbly loam, 15 to 25 percent slopes: PaD.	Severe: moderately steep slopes.	Severe: moderately steep slopes.	Severe: moderately steep slopes.	Severe: moderately steep slopes.	Severe: moderately steep slopes.
Pattenburg gravelly loam, 2 to 6 percent slopes: PbB.	Moderate: bedrock generally at a depth of 3½ to 8 feet or more.	Slight	Slight	Moderate: excessive gravel content.	Moderate: frost-action potential.
Pattenburg gravelly loam, 6 to 12 percent slopes, eroded: PbC2.	Moderate: bedrock generally at a depth of 3½ to 8 feet or more.	Moderate: bedrock generally at a depth of 3½ to 8 feet or more.	Slight	Moderate: strong slopes; excessive gravel content.	Moderate: frost-action potential.
Pattenburg gravelly loam, 12 to 18 percent slopes: PbD.	Severe: moderately steep slopes.	Moderate: moderately steep slopes; bedrock generally at a depth of 3½ to 6 feet.	Moderate: moderately steep slopes.	Severe: moderately steep slopes.	Severe: moderately steep slopes.
Pattenburg gravelly loam, 18 to 40 percent slopes: PbE.	Severe: steep slopes.	Severe: steep slopes.	Severe: steep slopes.	Severe: steep slopes.	Severe: steep slopes.
Pattenburg gravelly loam, moderately wet, 2 to 6 percent slopes: PcB.	Severe: seasonal high water table at a depth of 1 to 2½ feet.	Severe: seasonal high water table at a depth of 1 to 2½ feet.	Moderate: seasonal high water table at a depth of 1 to 2½ feet.	Moderate: seasonal high water table at a depth of 1 to 2½ feet.	Severe: seasonal high water table at a depth of 1 to 2½ feet; high frost-action potential.
Penn shaly silt loam, 2 to 6 percent slopes: PeB.	Severe: rippable shale bedrock at a depth of 1½ to 3½ feet.	Moderate: rippable shale bedrock at a depth of 1½ to 3½ feet.	Slight	Slight	Moderate: frost-action potential.
Penn shaly silt loam, 6 to 12 percent slopes, eroded: PeC2.	Severe: rippable shale bedrock at a depth of 1½ to 3½ feet.	Moderate: rippable shale bedrock at a depth of 1½ to 3½ feet.	Slight	Moderate: strong slopes.	Moderate: frost-action potential.
Penn shaly silt loam, 12 to 18 percent slopes: PeD.	Severe: rippable shale bedrock at a depth of 1½ to 3½ feet.	Moderate: rippable shale bedrock at a depth of 1½ to 3½ feet.	Moderate: moderately steep slopes.	Severe: moderately steep slopes.	Severe: moderately steep slopes.
Penn-Bucks complex, 2 to 6 percent slopes: PfB.					
Penn	Severe: rippable shale bedrock at a depth of 1½ to 3½ feet.	Moderate: rippable shale bedrock at a depth of 1½ to 3½ feet.	Slight	Slight	Moderate: frost-action potential.
Bucks	Moderate: bedrock generally at a depth of 4 to 6 feet; moderately slow permeability.	Slight: rippable bedrock at a depth of 4 to 6 feet.	Slight	Slight	Moderate: frost-action potential.

See footnote at end of table.

to town and country planning—Continued

Parking lots	Athletic fields	Picnic areas	Campsites (trailers and tents)	Sanitary landfill [1]	Cemeteries
Severe: moderately steep slopes.	Severe: moderately steep slopes.	Severe: moderately steep slopes.	Severe: moderately steep slopes.	Severe: low filter material; rapid permeability causes pollution hazard.	Severe: moderately steep slopes.
Moderate: frost-action potential.	Moderate: gentle slopes; excessive gravel content in places.	Slight	Slight	Moderate where bedrock is at a depth of 6 to 8 feet. Severe where bedrock is at a depth of less than 6 feet.	Moderate: bedrock generally at a depth of 3½ to 8 feet.
Severe: strong slopes.	Severe: strong slopes.	Moderate: strong slopes.	Moderate: strong slopes.	Moderate: bedrock generally at a depth of 3½ to 8 feet or more.	Moderate: bedrock generally at a depth of 3½ to 8 feet or more.
Severe: moderately steep slopes.	Severe: moderately steep slopes.	Severe: moderately steep slopes.	Severe: moderately steep slopes.	Severe: moderately steep slopes.	Moderate: moderately steep slopes.
Severe: steep slopes.	Severe: steep slopes.	Severe: steep slopes.	Severe: steep slopes.	Severe: steep slopes.	Severe: steep slopes.
Severe: seasonal high water table at a depth of 1 to 2½ feet; high frost-action potential.	Severe: seasonal high water table at a depth of 1 to 2½ feet.	Slight: water table below a depth of 20 inches in picnic season.	Slight: water table below a depth of 20 inches in camping season.	Severe: seasonal high water table at a depth of 1 to 2½ feet.	Severe: seasonal high water table at a depth of 1 to 2½ feet.
Moderate: frost-action potential.	Moderate: gentle slopes.	Slight	Slight	Severe: rippable shale bedrock at a depth of 1½ to 3½ feet.	Moderate: rippable shale bedrock at a depth of 1½ to 3½ feet.
Severe: strong slopes.	Severe: strong slopes; bedrock at a depth of 1½ to 3½ feet.	Moderate: strong slopes.	Moderate: strong slopes.	Severe: rippable shale bedrock at a depth of 1½ to 3½ feet.	Moderate: rippable shale bedrock at a depth of 1½ to 3½ feet.
Severe: moderately steep slopes.	Severe: moderately steep slopes.	Severe: moderately steep slopes.	Severe: moderately steep slopes.	Severe: rippable shale bedrock at a depth of 1½ to 3½ feet.	Severe: rippable shale bedrock at a depth of 1½ to 3½ feet; moderately steep slopes.
Moderate: frost-action potential.	Moderate: gentle slopes.	Slight	Slight	Severe: rippable shale bedrock at a depth of 1½ to 3½ feet.	Moderate: rippable shale bedrock at a depth of 1½ to 3½ feet.
Moderate: frost-action potential.	Moderate: gentle slopes.	Slight	Slight	Severe: rippable bedrock generally at a depth of 4 to 6 feet.	Moderate: rippable bedrock at a depth of 4 to 6 feet.

TABLE 10.—*Limitations for uses related*

Soil	Disposal of sewage effluent (onsite)[1]	Foundations for dwellings—		Lawns and landscaping	Local roads
		With basements	Without basements		
Penn-Bucks complex, 6 to 12 percent slopes eroded: PfC2.					
Penn	Severe: rippable shale bedrock at a depth of 1½ to 3½ feet.	Moderate: rippable shale bedrock at a depth of 1½ to 3½ feet.	Slight	Moderate: strong slopes.	Moderate: frost-action potential.
Bucks	Moderate: bedrock generally at a depth of 3½ to 5 feet; moderately slow permeability.	Slight: rippable bedrock at a depth of 3½ to 5 feet.	Slight	Moderate: strong slopes.	Moderate: frost-action potential.
Pope fine sandy loam, high bottom: Pk.	Slight where there is no flooding; severe where subject to flooding; ground-water pollution likely.	Slight where there is no flooding; severe where subject to flooding.	Slight where there is no flooding; severe where subject to flooding.	Slight	Moderate: frost-action potential.
Quakertown silt loam, 0 to 2 percent slopes: QkA.	Moderate: bedrock generally at a depth of 4 to 6 feet.	Slight: rippable bedrock generally at a depth of 4 to 6 feet.	Slight	Slight	Moderate: frost-action potential.
Quakertown silt loam, 2 to 6 percent slopes: QkB.	Moderate: bedrock generally at a depth of 4 to 6 feet.	Slight: rippable bedrock generally at a depth of 4 to 6 feet.	Slight	Slight	Moderate: frost-action potential.
Quakertown silt loam, 6 to 12 percent slopes, eroded: QkC2.	Moderate: bedrock generally at a depth of 4 to 6 feet.	Slight: rippable bedrock generally at a depth of 4 to 6 feet.	Slight	Moderate: strong slopes.	Moderate: frost-action potential.
Quakertown silt loam, 12 to 18 percent slopes, eroded: QkD2.	Severe: moderately steep slopes.	Moderate: moderately steep slopes.	Moderate: moderately steep slopes.	Severe: moderately steep slopes.	Severe: moderately steep slopes.
Quakertown-Chalfont silt loams, 6 to 12 percent slopes, eroded: QlC2.					
Quakertown	Moderate: bedrock generally at a depth of 4 to 6 feet.	Slight: rippable bedrock generally at a depth of 4 to 6 feet.	Slight	Moderate: strong slopes.	Moderate: frost-action potential.
Chalfont	Severe: seasonal high water at a depth of ½ to 1½ feet.	Severe: seasonal high water at a depth of ½ to 1½ feet.	Moderate: seasonal high water at a depth of ½ to 1½ feet.	Moderate: seasonal high water at a depth of ½ to 1½ feet.	Severe: seasonal high water at a depth of ½ to 1½ feet; high frost-action potential.
Raritan silt loam, 0 to 2 percent slopes: RbA.	Severe: seasonal high water at a depth of 1 to 2 feet.	Severe: seasonal high water at a depth of 1 to 2 feet.	Moderate: seasonal high water at a depth of 1 to 2 feet.	Moderate: seasonal high water at a depth of 1 to 2 feet.	Severe: seasonal high water at a depth of 1 to 2 feet; high frost-action potential.
Raritan silt loam, 2 to 6 percent slopes: RbB.	Severe: seasonal high water at a depth of 1 to 2 feet.	Severe: seasonal high water at a depth of 1 to 2 feet.	Moderate: seasonal high water at a depth of 1 to 2 feet.	Moderate: seasonal high water at a depth of 1 to 2 feet.	Severe: seasonal high water at a depth of 1 to 2 feet; high frost-action potential.

See footnote at end of table.

to town and country planning—Continued

Parking lots	Athletic fields	Picnic areas	Campsites (trailers and tents)	Sanitary landfill [1]	Cemeteries
Severe: strong slopes.	Severe: strong slopes; bedrock at a depth of 1½ to 3½ feet.	Moderate: strong slopes.	Moderate: strong slopes.	Severe: rippable shale bedrock at a depth of 1½ to 3½ feet.	Moderate: rippable shale bedrock at a depth of 1½ to 3½ feet.
Severe: frost-action potential; strong slopes.	Severe: strong slopes.	Moderate: strong slopes.	Moderate: strong slopes.	Severe: rippable bedrock generally at a depth of 3½ to 5 feet.	Moderate: rippable bedrock at a depth of 3½ to 5 feet.
Moderate: frost-action potential.	Slight where there is no flooding.	Slight	Slight where there is no flooding.	Severe: pollution hazard.	Slight.
Moderate: frost-action potential.	Slight	Slight	Slight	Severe: rippable bedrock at a depth of 4 to 6 feet.	Slight: rippable bedrock at a depth of 4 to 6 feet.
Moderate: frost-action potential.	Moderate: gentle slopes.	Slight	Slight	Severe: rippable bedrock at a depth of 4 to 6 feet.	Slight: rippable bedrock at a depth of 4 to 6 feet.
Severe: strong slopes.	Severe: strong slopes.	Moderate: strong slopes.	Moderate: strong slopes.	Severe: rippable bedrock at a depth of 4 to 6 feet.	Slight: rippable bedrock at a depth of 4 to 6 feet.
Severe: moderately steep slopes.	Severe: moderately steep slopes.	Severe: moderately steep slopes.	Severe: moderately steep slopes.	Severe: moderately steep slopes.	Moderate: moderately steep slopes.
Severe: strong slopes.	Severe: strong slopes.	Moderate: strong slopes.	Moderate: strong slopes.	Severe: rippable bedrock at a depth of 4 to 6 feet.	Slight: rippable bedrock at a depth of 4 to 6 feet.
Severe: seasonal high water at a depth of ½ to 1½ feet; high frost-action potential.	Severe: seasonal high water at a depth of ½ to 1½ feet.	Moderate: water below a depth of 20 inches in picnic season.	Moderate: water below a depth of 30 inches in camping season.	Severe: seasonal high water at a depth of ½ to 1½ feet; bedrock at a depth of 3½ to 6 feet.	Severe: seasonal high water at a depth of ½ to 1½ feet; bedrock at a depth of 3½ to 6 feet.
Severe: seasonal high water at a depth of 1 to 2 feet; high frost-action potential.	Moderate: seasonal high water at a depth of 1 to 2 feet.	Moderate: water below a depth of 20 inches in picnic season.	Severe: seasonal high water at a depth of 1 to 2 feet.	Severe: groundwater pollution hazard.	Severe: seasonal high water at a depth of 1 to 2 feet.
Severe: seasonal high water at a depth of 1 to 2 feet; high frost-action potential.	Moderate: seasonal high water at a depth of 1 to 2 feet.	Moderate: water below a depth of 20 inches in picnic season.	Severe: seasonal high water at a depth of 1 to 2 feet.	Severe: groundwater pollution hazard.	Severe: seasonal high water at a depth of 1 to 2 feet.

TABLE 10.—*Limitations for uses related*

Soil	Disposal of sewage effluent (onsite)[1]	Foundations for dwellings—		Lawns and landscaping	Local roads
		With basements	Without basements		
Readington silt loam, 2 to 6 percent slopes: RcB.	Moderate: seasonal high water at a depth of 1½ to 3 feet; rippable bedrock at a depth of 3½ to 5 feet.	Moderate: seasonal high water at a depth of 1½ to 3 feet; rippable bedrock at a depth of 3½ to 5 feet.	Slight	Slight	Severe: seasonal high water at a depth of 1½ to 3 feet.
Readington silt loam, 6 to 12 percent slopes, eroded: RcC2.	Moderate: seasonal high water at a depth of 1½ to 3 feet; rippable bedrock at a depth of 3½ to 5 feet.	Moderate: seasonal high water at a depth of 1½ to 3 feet; rippable bedrock at a depth of 3½ to 5 feet.	Slight	Moderate: strong slopes.	Severe: seasonal high water at a depth of 1½ to 3 feet; high frost-action potential.
Reaville silt loam, 0 to 2 percent slopes: ReA.	Severe: seasonal high water table at a depth of 1 to 2½ feet; bedrock at a depth of 1½ to 2½ feet.	Severe: seasonal high water table at a depth of 1 to 2½ feet; bedrock at a depth of 1½ to 2½ feet.	Moderate: seasonal high water table at a depth of 1 to 2½ feet.	Moderate: seasonal high water table at a depth of 1 to 2½ feet.	Severe: seasonal high water table at a depth of 1 to 2½ feet; high frost-action potential.
Reaville silt loam, 2 to 6 percent slopes: ReB.	Severe: seasonal high water table at a depth of 1 to 2½ feet; bedrock at a depth of 1½ to 2½ feet.	Severe: seasonal high water table at a depth of 1 to 2½ feet; bedrock at a depth of 1½ to 2½ feet.	Moderate: seasonal high water table at a depth of 1 to 2½ feet.	Moderate: seasonal high water table at a depth of 1 to 2½ feet.	Severe: seasonal high water table at a depth of 1 to 2½ feet; high frost-action potential.
Reaville silt loam, 6 to 12 percent slopes, eroded: ReC2.	Severe: seasonal high water table at a depth of 1 to 2½ feet; bedrock at a depth of 1½ to 2½ feet.	Severe: seasonal high water table at a depth of 1 to 2½ feet; bedrock at a depth of 1½ to 2½ feet.	Moderate: seasonal high water table at a depth of 1 to 2½ feet.	Moderate: seasonal high water table at a depth of 1 to 2½ feet.	Severe: seasonal high water table at a depth of 1 to 2½ feet; high frost-action potential.
Reaville silt loam, wet variant, 0 to 2 percent slopes: RfA.	Severe: seasonal high water table at a depth of 0 to 1 foot; rippable bedrock at a depth of 1½ to 2½ feet.	Severe: seasonal high water table at a depth of 0 to 1 foot; rippable bedrock at a depth of 1½ to 2½ feet.	Severe: seasonal high water table at a depth of 0 to 1 foot.	Severe: seasonal high water table at a depth of 0 to 1 foot.	Severe: seasonal high water table at a depth of 0 to 1 foot.
Reaville silt loam, wet variant, 2 to 6 percent slopes: RfB.	Severe: seasonal high water table at a depth of 0 to 1 foot; rippable bedrock at a depth of 1½ to 2½ feet.	Severe: seasonal high water table at a depth of 0 to 1 foot; rippable bedrock at a depth of 1½ to 2½ feet.	Severe: seasonal high water table at a depth of 0 to 1 foot.	Severe: seasonal high water table at a depth of 0 to 1 foot.	Severe: seasonal high water table at a depth of 0 to 1 foot.
Riverhead gravelly sandy loam, 2 to 6 percent slopes: RgB.	Slight: ground-water pollution hazard.	Slight	Slight	Slight	Moderate: frost-action potential.

See footnote at end of table.

to town and country planning—Continued

Parking lots	Athletic fields	Picnic areas	Campsites (trailers and tents)	Sanitary landfill [1]	Cemeteries
Severe: seasonal high water at a depth of 1½ to 3 feet.	Moderate: seasonal high water at a depth of 1½ to 3 feet.	Slight	Slight	Severe: rippable bedrock at a depth of 3½ to 5 feet; seasonal high water at a depth of 1½ to 3 feet.	Severe: seasonal high water at a depth of 1½ to 3 feet.
Severe: strong slopes; seasonal high water at a depth of 1½ to 3 feet.	Severe: strong slopes; seasonal high water at a depth of 1½ to 3 feet.	Moderate: strong slopes; seasonal high water at a depth of 1½ to 3 feet.	Moderate: strong slopes; water below a depth of 20 inches in camping season.	Severe: rippable bedrock at a depth of 3½ to 5 feet; seasonal high water at a depth of 1½ to 3 feet.	Severe: seasonal high water at a depth of 1½ to 3 feet.
Severe: seasonal high water table at a depth of 1 to 2½ feet; high frost-action potential.	Severe: seasonal high water table at a depth of 1 to 2½ feet.	Slight: water table below a depth of 20 inches in picnic season.	Moderate: water table below a depth of 20 inches in camping season.	Severe: rippable bedrock at a depth of 3½ to 5 feet; seasonal high water at a depth of 1½ to 3 feet.	Severe: seasonal high water at a depth of 1½ to 3 feet.
Severe: seasonal high water table at a depth of 1 to 2½ feet; high frost-action potential.	Severe: seasonal high water table at a depth of 1 to 2½ feet.	Slight: water table below a depth of 20 inches in picnic season.	Moderate: water table below a depth of 20 inches in camping season.	Severe: rippable bedrock at a depth of 3½ to 5 feet; seasonal high water table at a depth of 1½ to 3 feet.	Severe: seasonal high water table at a depth of 1½ to 3 feet.
Severe: seasonal high water table at a depth of 1 to 2½ feet; high frost-action potential; strong slopes.	Severe: seasonal high water table at a depth of 1 to 2½ feet; strong slopes.	Moderate: strong slopes.	Moderate: strong slopes.	Severe: rippable bedrock at a depth of 3½ to 5 feet; seasonal high water table at a depth of 1½ to 3 feet.	Severe: seasonal high water table at a depth of 1½ to 3 feet.
Severe: seasonal high water table at a depth of 0 to 1 foot.	Severe: seasonal high water table at a depth of 0 to 1 foot.	Severe: seasonal high water table at a depth of 0 to 1 foot.	Severe: seasonal high water table at a depth of 0 to 1 foot.	Severe: seasonal high water table at a depth of 0 to 1 foot; rippable bedrock at a depth of 1½ to 2½ feet.	Severe: seasonal high water table at a depth of 0 to 1 foot.
Severe: seasonal high water table at a depth of 0 to 1 foot.	Severe: seasonal high water table at a depth of 0 to 1 foot.	Severe: seasonal high water table at a depth of 0 to 1 foot.	Severe: seasonal high water table at a depth of 0 to 1 foot.	Severe: seasonal high water table at a depth of 0 to 1 foot; rippable bedrock at a depth of 1½ to 2½ feet.	Severe: seasonal high water table at a depth of 0 to 1 foot.
Moderate: frost-action potential.	Moderate where coarse-fragment content is less than 20 percent. Severe where coarse-fragment content is more than 20 percent.	Slight	Slight where coarse-fragment content is less than 20 percent. Moderate where coarse-fragment content is more than 20 percent.	Severe: ground-water pollution hazard.	Slight.

TABLE 10.—*Limitations for uses related*

Soil	Disposal of sewage effluent (onsite)[1]	Foundations for dwellings—		Lawns and landscaping	Local roads
		With basements	Without basements		
Riverhead gravelly sandy loam, 6 to 18 percent slopes: RgC.	Moderate: groundwater pollution hazard.	Slight for slopes of 6 to 12 percent. Moderate for slopes of 12 to 18 percent.	Slight for slopes of 6 to 12 percent. Moderate for slopes of 12 to 18 percent.	Severe: some moderately steep slopes.	Moderate for slopes of 6 to 12 percent. Severe for slopes of 12 to 18 percent.
Rock land, Edneyville material: Rk.	Severe: rock obstructions.	Severe: rock obstructions.	Severe: rock obstructions.	Severe: rock obstructions.	Severe: rock obstructions.
Rough broken land, shale: RlF.	Severe: very steep; shallow to bedrock.	Severe: very steep; shallow to bedrock.	Severe: very steep; shallow to bedrock.	Severe: very steep; shallow to bedrock.	Severe: very steep; shallow to bedrock.
Rowland silt loam: Ro.	Severe: very frequent flooding.	Severe: very frequent flooding.	Severe: very frequent flooding.	Severe: very frequent flooding.	Severe: very frequent flooding.
Steep stony land, Parker material: SpF.	Severe: very steep; extremely high stone content.	Severe: very steep; extremely high stone content.	Severe: very steep; extremely high stone content.	Severe: very steep; extremely high stone content.	Severe: very steep; extremely high stone content.
Turbotville loam, 2 to 6 percent slopes: TuB.	Severe: seasonal high water at a depth of ½ to 1½ feet.	Severe: seasonal high water at a depth of ½ to 1½ feet.	Moderate: seasonal high water at a depth of ½ to 1½ feet.	Moderate: seasonal high water at a depth of ½ to 1½ feet.	Severe: seasonal high water at a depth of ½ to 1½ feet; high frost-action potential.
Washington loam, 2 to 6 percent slopes: WaB.	Slight: groundwater pollution hazard where bedrock is cavernous.	Slight	Slight	Slight	Moderate: frost-action potential.
Washington loam, 6 to 12 percent slopes, eroded: WaC2.	Slight: groundwater pollution hazard where bedrock is cavernous.	Slight	Slight	Moderate: strong slopes.	Moderate: frost-action potential.
Watchung silt loam: Wc.	Severe: seasonal high water table at a depth of 0 to 1 foot.	Severe: seasonal high water table at a depth of 0 to 1 foot.	Severe: seasonal high water table at a depth of 0 to 1 foot.	Severe: seasonal high water table at a depth of 0 to 1 foot.	Severe: seasonal high water table at a depth of 0 to 1 foot.

[1] Onsite investigation needed to determine conditions below a depth of 5 feet.

to town and country planning—Continued

Parking lots	Athletic fields	Picnic areas	Campsites (trailers and tents)	Sanitary landfill [1]	Cemeteries
Severe: strong or moderately steep slopes.	Severe: strong or moderately steep slopes.	Moderate for slopes of 6 to 12 percent. Severe for slopes of 12 to 18 percent.	Moderate for slopes of 6 to 12 percent. Severe for slopes of 12 to 18 percent.	Severe: ground-water pollution hazard.	Slight.
Severe: rock obstructions.	Severe: rock obstructions.	Severe: rock obstructions.	Severe: rock obstructions.	Severe: rock obstructions.	Severe: rock obstructions.
Severe: very steep; shallow to bedrock.	Severe: very steep; shallow to bedrock.	Severe: very steep; shallow to bedrock.	Severe: very steep; shallow to bedrock.	Severe: very steep; shallow to bedrock.	Severe: very steep; shallow to bedrock.
Severe: very frequent flooding.	Severe: very frequent flooding.	Severe: very frequent flooding.	Severe: very frequent flooding.	Severe: very frequent flooding.	Severe: very frequent flooding.
Severe: very steep; extremely high stone content.	Severe: very steep; extremely high stone content.	Severe: very steep; extremely high stone content.	Severe; very steep; extremely high stone content.	Severe: very steep; extremely high stone content.	Severe: very steep; extremely high stone content.
Severe: seasonal high water at a depth of ½ to 1½ feet; high frost-action potential.	Moderate: seasonal high water at a depth of ½ to 1½ feet.	Slight: water below a depth of 20 inches in picnic season.	Moderate: water below a depth of 20 inches in camping season.	Severe: seasonal high water at a depth of ½ to 1½ feet; bedrock cavernous in places.	Severe: seasonal high water at a depth of ½ to 1½ feet.
Moderate: frost-action potential.	Moderate: slopes 2 to 6 percent.	Slight	Slight	Slight where bedrock is at a depth of more than 8 feet and not cavernous. Moderate where bedrock is at a depth of 6 to 8 feet and not cavernous. Severe where bedrock is cavernous or at a depth of less than 6 feet.	Slight.
Severe: strong slopes.	Severe: strong slopes.	Moderate: strong slopes.	Moderate: strong slopes.	Slight where bedrock is at a depth of more than 8 feet and not cavernous. Moderate where bedrock is at a depth of 6 to 8 feet and not cavernous. Severe where bedrock is cavernous or at a depth of less than 6 feet.	Slight.
Severe: seasonal high water table at a depth of 0 to 1 foot.	Severe: seasonal high water table at a depth of 0 to 1 foot.	Severe: seasonal high water table above a depth of 20 inches for about a month in picnic season.	Severe: seasonal high water table above a depth of 20 inches in camping season.	Severe: seasonal high water table at a depth of 0 to 1 foot.	Severe: seasonal high water table at a depth of 0 to 1 foot.

Formation and Classification of the Soils

This section discusses the factors of soil formation as they exist in Hunterdon County, the processes through which soil horizons develop, the nature of the major horizons in mature soils, and the classification of the soils of the county according to the current classification system.

Factors of Soil Formation

Soils form through the interaction of five major factors: climate, plant and animal life, parent material, topography, and time. The relative influence of each factor varies from place to place. Local variations in soils are due to differences in kind of parent material and differences in topography and drainage. In places one factor dominates in the formation of a soil and determines most of its properties. Table 11 shows the parent material, the topographic position, and the drainage class of the soils of this county, by series.

Climate

The climate of Hunterdon County is characteristic of a humid continental type that is marked by extreme seasonal temperature changes. It has an annual precipitation of about 45 inches and a mean annual air temperature of about 53° F. The rainfall is fairly uniform during the growing season of May through September and averages about 21 inches. The cool temperature has promoted the accumulation of organic matter in the surface layer of the soils. More detailed information on climate is given in the section "Physiography and Relief."

Plant and animal life

Plants, micro-organisms, earthworms, and other forms of life on and in the soil are active factors in soil formation. The kinds of plants and animals depend on the climate, the parent material, the age of the soil, and the presence of other organisms.

All of the soils in Hunterdon County formed under forests, mostly of hardwoods. Organic matter was added to the soil in the form of decayed leaves, twigs, roots, and entire plants. Most of this material accumulated on the surface, where it was acted on by micro-organisms, earthworms, termites and other forms of life, and by direct chemical reaction.

Man's activities, including land clearing, stone removal, cultivation, the introduction of new plants, and artificial drainage, have affected soil development. The most apparent widespread results of these activities are accelerated erosion of the steeper soils and the resulting deposition on lower slopes, the alteration of the surface layer by tillage, the reduction of acidity by the addition of lime, and the raising of the fertility level by the addition of fertilizer.

In addition man has made some drastic changes locally. He has removed the original soil or so mixed it during recent construction projects that soil formation has started anew.

Parent material

Parent material is the unconsolidated mass from which a soil forms. It determines the mineralogical and chemical composition of the soil and, to a large extent, the rate of the soil-forming processes.

The soils of Hunterdon County have formed in either residual material weathered from underlying rocks or transported material deposited by water, glacial ice, wind, or gravity.

Hazleton, Penn, and Klinesville soils, which are in the southern two-thirds of the county, are examples of soils that formed in residuum weathered from the sedimentary shale, sandstone, or argillite. These soils commonly contain numerous flat fragments.

Neshaminy and Mount Lucas are examples of soils that formed in residuum weathered from igneous diabase or basalt rocks. These relatively hard rocks form the hills and ridges in the southern part of the county. These soils are typically sloping and contain many stones and boulders.

Edneyville and Parker soils, which are in the northern part of the county, formed in residuum weathered from granitic gneiss.

The soils that formed in transported material have a great variety of composition, texture, and landform. Annandale soils formed in material from glacial deposits in the Highlands and are composed dominantly of weathered granitic gneiss. Norton soils formed in glacial deposits that contained a high proportion of soft red shale. Rowland and Bowmansville soils formed on flood plains in recent silty deposits of alluvium. These soils are young and have weakly developed profiles. Birdsboro and Riverhead soils occur on terraces in older deposits of alluvium and, therefore, have better differentiated soil horizons. Bucks soils formed in uniform silty deposits, possibly windblown.

Topography

Hunterdon County has two-thirds of its acreage in the Piedmont Plateau area and about one-third in the Highland area. Elevation ranges from 50 feet near Lambertville to a little over 1,000 near Penwell.

The Piedmont area in the county is made up of gently undulating and moderately sloping plains and of narrow flood plains along the major streams. A steep ridge (Sourland Mountain) crosses the southern part of the county, and a horseshoe-shaped, steep ridge (Cushetunk Mountain) occurs in the vicinity of Lebanon and White House. Bluff-like escarpments occur adjacent to the main streams, especially along the Delaware River.

The Highland area is made up of moderate slopes on the upland areas, but drops abruptly to the bordering lowlands of the Piedmont Plateau. Some streams and drainageways have cut deeply into the hills, making deep indentations.

Time

The length of time the parent material has been in place and exposed to the active forces of climate and vegetation is reflected in the degree of horizon differentiation, but this is influenced by other factors as well as time. A mature soil is one that has well-defined, genetically related horizons; an immature soil is one that shows little or no horizonation. In this county deep soils that have clearly expressed horizons indicate that the soil material has been in the same place for thousands of years. Soil horizons have formed as a result of the movement of clays, organic matter, and

TABLE 11.—*Topographic position, parent material, and drainage class of soils of Hunterdon County*

Topographic position and principal kind of underlying material	Well-drained soils			Moderately well drained soils	Somewhat poorly drained soils	Poorly drained soils
	Shallow	Moderately deep	Deep			
Soils on Uplands						
Sedimentary shale, sandstone, and conglomerate:						
Red, acid shale or siltstone	Klinesville	Penn	Bucks	Readington	Abbottstown	Croton.
Brown, acid, fine-grained sandstone			Quakertown			
Red quartzose conglomerate			Pattenburg	Pattenburg, moderately wet.		
Acid, gray, brown, or yellow sandstone or shale.			Hazleton			
Mixed red and yellow, acid shale or sandstone.			Lansdale			
Dark-colored metamorphosed shale				Lehigh	Lehigh	
Thinly bedded, brown, acid shale and sandstone.		Berks	Bedington			
Thick silt deposits over red shale, sandstone, or argillite.				Lawrenceville	Chalfont	Croton.
Till or frost-worked materials from red shale:						
More than 35 percent clay subsoil			Norton	Lansdowne	Lansdowne	Croton.
Less than 35 percent clay subsoil			Meckesville			
Limestone, dolomite, or conglomerate:						
Limestone or dolomite			Duffield			
Yellowish-brown, neutral till over gray limestone.			Washington		Turbotville	
Limestone conglomerate			Athol			
Granite, granite gneiss, or diabase:						
Yellowish-brown, slightly acid till over granite or granite gneiss.			Annandale	Califon	Califon	Cokesbury.
Residuum from granite gneiss—						
Less than 35 percent coarse fragments.			Edneyville			
More than 35 percent coarse fragments.			Parker			
Residuum from diabase—						
Solum less than 30 inches thick			Legore			
Solum more than 30 inches thick.			Neshaminy	Mount Lucas	Mount Lucas	Watchung.
Soils on Stream Terraces						
Sediment from red shale, siltstone, and sandstone.			Birdsboro	Raritan	Raritan	
Yellowish-brown and brown, sandy and gravelly material of glacial outwash plains.			Riverhead			
Soils on Flood Plains						
Medium-textured alluvium washed from soils derived from red shale, siltstone, sandstone, or diabase.				Rowland	Rowland	Bowmansville.
Mixed gray and brown sediment from quartzose, shale, siltstone, and sandstone.			Pope, high bottom.			

bases from the A horizons into the B horizons. This movement was caused by the action of water over long periods of time. Young soils on the flood plains do not have such characteristic horizons.

Processes of Horizon Differentiation

Several processes are involved in the formation of soil horizons in the soils of Hunterdon County. These include the accumulation of organic matter; the leaching of soluble salts; the reduction and translocation of iron; the formation of soil structure; and some translocation and loss of clay minerals, aluminum, silica, and iron. The processes are continually taking place and generally at the same time throughout the profile. These processes are measured in thousands of years.

The accumulation of organic matter takes place with the decomposition of plant residue. This process darkens

the surface layer and helps form the A1 horizon. Organic matter, once it has been lost, takes a long time to replace. The surface soils of this county average about 3.5 percent organic matter.

Soils in Hunterdon County have distinct subsoil horizons. It is believed that some of the lime and other soluble salts are leached before translocation of iron and clay takes place. Many factors affect this leaching, such as the kinds of salts originally present, the depth to which the soil solution percolates, and the texture of the soil profile.

Most well-drained and moderately well drained soils in Hunterdon County have yellowish-brown or reddish-brown horizons in the subsoil. These colors result mainly from the thin coatings of iron oxides on sand and silt grains. In some soils, like those of the Lehigh series, the colors are inherited from the underlying bedrock. Weak to moderate development of subangular blocky structure has taken place, and the subsoil generally contains considerably more clay than the overlying surface horizons.

The reduction and transfer of iron is associated mainly with the wetter, more poorly drained soils. This process is called gleying. Poorly drained to very poorly drained soils, such as those in Croton, Cokesbury, and Watchung, series, have a subsoil and underlying material that are grayish in color, indicating a reduction and transfer of iron. Moderately well drained to somewhat poorly drained soils have yellowish-brown, reddish-brown, and gray mottles, indicating the segregation of iron.

Fragipans developed in the subsoil of most moderately well drained and somewhat poorly drained soils. These horizons are very firm and brittle when moist and hard when dry. Soil particles are tightly packed so that bulk density is high and pore space is low. Genesis of these horizons is not fully understood, but studies show that swelling and shrinking takes place in alternating wet and dry periods. This may account for the tight packing of soil particles and also the gross polygonal pattern of cracks in fragipan. Clay, silica, and oxides of aluminum are the most likely cementing agents that cause brittleness and hardness.

Major Soil Horizons

The results of the soil-forming factors and processes can be distinguished by the different layers, or soil horizons, seen in a soil profile. The soil profile extends from the surface down to material that is little altered by the soil-forming processes.

Most soils contain three major horizons identified A, B, and C (*12*). These major horizons may be further subdivided by the use of numerals and letters to indicate changes within one horizon. An example would be the B2t horizon, a layer within the B horizon that contains translocated clay illuviated from the A horizon.

The A horizon is the surface layer. The uppermost part, which contains the largest accumulation of organic matter, is called an A1 horizon. It is also the layer of maximum leaching or eluviation of clay and iron. When considerable leaching has taken place, an A2 horizon is formed. The A2 horizon of some soils in Hunterdon County show brownish colors as a result of the oxidation of iron.

The B horizon lies beneath the A horizon and is commonly called the subsoil. It is the horizon of maximum accumulation, or illuviation, of clay, iron, aluminum, or other compounds leached from the A horizon. In some soils the B horizon is formed through alteration in place rather than through illuviation. The alteration may be caused by oxidation and reduction of iron or by the weathering of clay minerals. Generally the B horizon is firmer than the A horizon and has blocky or prismatic structure. It generally is lighter in color than the A1 horizon but darker than the C horizon. Most young soils do not have a B horizon.

The C horizon is below the A or B horizon. It consists of material that has been little altered by the soil-forming processes but has been modified by weathering.

Classification of the Soils

Soils are classified so that we can more easily remember their significant characteristics. Classification enables us to assemble knowledge about the soils, to see their relationship to one another and to the whole environment, and to develop principles that help us to understand their behavior and their response to manipulation. First through classification and then through use of soil maps, we can apply our knowledge of soils to specific fields and other tracts.

Thus, in classification, soils are placed in narrow categories that are used in detailed soil surveys so that knowledge about the soils can be organized and applied in managing farms, fields, and woods; in developing rural areas; in doing engineering work; and in many other ways. They are placed in broad classes to facilitate study and comparison in large areas, such as countries and continents.

The system of soil classification currently used and described in this section was adopted for general use by the National Cooperative Soil Survey in 1965 and supplemented in March 1967. It replaced a system that had been in use since 1938 (*2, 11*). The current system is under continual study. Therefore, readers interested in developments of the system should search for the latest literature available.

The current system defines categories in terms of observable or measurable properties of soils (*9, 13*). The properties chosen are primarily those that permit the grouping of soils that are similar in genesis, although genesis, or mode of origin, does not appear in the definition of the classes. The classification is designed to accommodate all soils. It has six categories. Beginning with the most inclusive, the categories are the order, the suborder, the great group, the subgroup, the family, and the series. Following are brief descriptions of each of the six categories in the system. Table 12 shows the family, subgroup, and order classification of the soil series of this county.

ORDER.—Ten soil orders are recognized. They are Entisols, Vertisols, Inceptisols, Aridisols, Mollisols, Spodosols, Alfisols, Ultisols, Oxisols, and Histosols. The properties used to differentiate the soil orders are those that tend to give broad climatic groupings of soils. The exceptions to this are the Entisols, Histosols, and, to some extent. Inceptisols, which occur in many different climates.

Four of the orders are represented in Hunterdon County: Alfisols, Entisols, Inceptisols, and Ultisols.

TABLE 12.—*Soil series of Hunterdon County classified by higher categories*

Series	Family	Subgroup	Order
Abbottstown	Fine-loamy, mixed, mesic	Aeric Fragiaqualfs	Alfisols.
Annandale	Fine-loamy, mixed, mesic	Typic Fragiudults	Ultisols.
Athol	Fine-loamy, mixed, mesic	Ultic Hapludalfs	Alfisols.
Bedington	Fine-loamy, mixed, mesic	Typic Hapludults	Ultisols.
Berks	Loamy-skeletal, mixed, mesic	Typic Dystrochrepts	Inceptisols.
Birdsboro	Fine-loamy, mixed, mesic	Typic Hapludults	Ultisols.
Bowmansville	Fine-loamy, mixed, nonacid, mesic	Aeric Fluvaquents	Entisols.
Bucks	Fine-loamy, mixed, mesic	Typic Hapludults	Ultisols.
Califon	Fine-loamy, mixed, mesic	Typic Fragiudults	Ultisols.
Chalfont	Fine-silty, mixed, mesic	Aquic Fragiudalfs	Alfisols.
Cokesbury	Fine-loamy, mixed, mesic	Typic Fragiaquults	Ultisols.
Croton	Fine-silty, mixed, mesic	Typic Fragiaqualfs	Alfisols.
Duffield	Fine-loamy, mixed, mesic	Ultic Hapludalfs	Alfisols.
Edneyville	Fine-loamy, mixed, mesic	Typic Hapludults	Ultisols.
Hazleton	Loamy-skeletal, mixed, mesic	Typic Dystrochrepts	Inceptisols.
Klinesville	Loamy-skeletal, mixed, mesic	Lithic Dystrochrepts	Inceptisols.
Lansdale [1]	Coarse-loamy, mixed, mesic	Typic Hapludults	Ultisols.
Lansdowne	Fine, mixed, mesic	Aquultic Hapludalfs	Alfisols.
Lawrenceville	Fine-silty, mixed, mesic	Typic Fragiudalfs	Alfisols.
Legore	Fine-loamy, mixed, mesic	Ultic Hapludalfs	Alfisols.
Lehigh	Fine-loamy, mixed, mesic	Aquic Hapludalfs	Alfisols.
Meckesville	Fine-loamy, mixed, mesic	Typic Fragiudults	Ultisols.
Mount Lucas	Fine-loamy, mixed, mesic	Aquic Hapludalfs	Alfisols.
Neshaminy	Fine-loamy, mixed, mesic	Ultic Hapludalfs	Alfisols.
Norton	Fine, mixed, mesic	Ultic Hapludalfs	Alfisols.
Parker	Loamy-skeletal, mixed, mesic	Typic Dystrochrepts	Inceptisols.
Pattenburg	Loamy-skeletal, mixed, mesic	Typic Hapludults	Ultisols.
Penn	Fine-loamy, mixed, mesic	Ultic Hapludalfs	Alfisols.
Pope [2]	Coarse-loamy, mixed, mesic	Fluventic Dystrochrepts	Inceptisols.
Quakertown	Fine-loamy, mixed, mesic	Typic Hapludults	Ultisols.
Raritan	Fine-loamy, mixed, mesic	Aquic Fragiudults	Ultisols.
Readington	Fine-loamy, mixed, mesic	Typic Fragiudalfs	Alfisols.
Reaville	Fine-loamy, mixed, mesic	Aquic Hapludalfs	Alfisols.
Reaville, wet variant	Fine-loamy, mixed, mesic	Aeric Ochraqualfs	Alfisols.
Riverhead [3]	Coarse-loamy, mixed, mesic	Typic Dystrochrepts	Inceptisols.
Rowland	Fine-loamy, mixed, mesic	Fluvaquentic Dystrochrepts	Inceptisols.
Turbotville	Fine-loamy, mixed, mesic	Aquic Fragiudalfs	Alfisols.
Washington	Fine-loamy, mixed, mesic	Ultic Hapludalfs	Alfisols.
Watchung [4]	Fine, mixed, mesic	Typic Ochraqualfs	Alfisols.

[1] These soils are taxadjuncts to the Lansdale series. They are outside the defined range for the series in that they are redder in the lower part of the B horizon.

[2] These soils are taxadjuncts to the Pope series. They are outside the defined range for the series in that reaction is higher in the lower part of the control section.

[3] These soils are taxadjuncts to the Riverhead series. They are outside the defined range for the series in that the gravel content in the solum is higher.

[4] These soils are taxadjuncts to the Watchung series. They are outside the defined range for the series in that the clay content is less than 35 percent in the Bt horizon.

Alfisols are mineral soils with distinct horizonation caused by translocation of clay and having base saturation of more than 35 percent. Representatives of this order are numerous in Hunterdon County; among them are Athol and Duffield soils.

Entisols are mineral soils with a low degree of horizonation. The Bowmansville soils are the only ones of this order in Hunterdon County.

Inceptisols are mineral soils in which horizons have started to develop. Berks and Hazleton soils are among the Inceptisols in Hunterdon County.

Ultisols are mineral soils with distinct horizonation caused by clay eluviation. They have a base saturation of less than 35 percent. Representatives of this order are numerous in Hunterdon County; among them are Bucks and Cokesbury soils.

SUBORDER.—Each order is divided into suborders, primarily on the basis of soil characteristics that seem to produce classes with the greatest genetic similarity. The climatic range is narrower than that of the order. The soil properties considered are mainly those that reflect the presence or absence of waterlogging or differences in climate or vegetation.

GREAT GROUP.—Each suborder is divided into great groups on the basis of differences in the nature and sequence of the major horizons and features. The horizons considered are those in which clay, iron, or humus have accumulated or those that have pans that interfere with the growth of roots or the movement of water. The features considered are the self-mulching properties of clay, soil temperature, major differences in chemical composition (mainly calcium, magnesium, sodium, and potassium), and the like.

SUBGROUP.—Each great group is divided into subgroups, one representing the central (typic) segment of the group and others, called intergrades, that have properties of the group and also have one or more properties of another group, suborder, or order. Subgroups may also be set up in those instances where soil properties intergrade outside of the range of any other great group, suborder, or order.

FAMILY.—Families are established within each subgroup primarily on the basis of properties important to the growth of plants or behavior of soils when used for engineering. Among the properties considered are texture, mineralogy, reaction, soil temperature, permeability, thickness of horizon, and consistence.

SERIES.—The series is a group of soils that have major horizons that, except for texture of the surface layer, are similar in important characteristics and in arrangement in the profile. They are given the name of a geographic location near the place where that series was first observed and mapped. An example is the Pattenburg series.

Additional Facts About the County

This section contains information about the physiography, relief, and climate of Hunterdon County.

Physiography and Relief

Hunterdon County is part of two physiographic divisions. They are both part of the Appalachian Province (*3*). About one-third of the northern part of the county is in the Highlands; the remainder lies in the Piedmont Plateau. In general, the Highlands is characterized by gently rolling to steep uplands and the Piedmont is nearly level lowlands with occasional low hills and ridges.

The Highlands section is underlain by gneiss, quartzite, and limestone rock. It is in the northern part of the county and generally has an elevation ranging from 200 feet to more than 1,000 feet above sea level.

The Piedmont section covering the remainder of the county south of the Highlands is underlain by sedimentary rocks consisting of shale, sandstone, argillite, and a much smaller percentage of igneous rock and diabase. The elevation ranges from about 100 feet to 500 feet above sea level.

Climate [4]

Hunterdon County, while humid and temperate, has continental climate that is influenced only slightly by the ocean. The data given in tables 13 and 14 are from the cooperative weather station at Flemington.

Summer temperatures occasionally exceed 100° F., but temperatures in the mid or upper 90's occur frequently. Winter temperatures generally are not below 10° F. for long periods, but drainage tile must be placed below a depth of 40 inches for protection against freezing.

The average annual precipitation is about 45 inches, and the monthly averages show that precipitation is well distributed over the year. Nearly every year, however, there are periods when rainfall is not enough to supply moisture for high-value crops. Consequently the irrigated acreage has increased considerably in recent years, especially during the drought of 1961–1966. Rainfall is heaviest in July and August. Much of the rainfall in the summer months comes as thunderstorms—about 33 occur annually. More than 16 inches of rain fell during August 1955. Thunderstorms and two hurricanes occurred during this period.

The average length of the growing season in the county is about 167 days. The average date of the last killing freeze in spring is April 29th, and that of the first in fall is October 13th. Probabilities for the last damaging cold temperature in spring and the first in fall are listed in table 14.

[4] Prepared by DONALD V. DUNLAP, State climatologist.

TABLE 13.—*Temperature and precipitation data*

[All data from Flemington, New Jersey]

Month	Temperature				Precipitation				
	Average daily maximum	Average daily minimum	Two years in 10 will have at least 4 days with—		Average total	One year in 10 will have —		Days with snow cover of 1 inch or more	Average depth of snow on days with snow cover
			Maximum temperature higher than—	Minimum temperature lower than—		Less than—	More than—		
	°F.	°F.	°F.	°F.	*Inches*	*Inches*	*Inches*	*Number*	*Inches*
January	40	22	55	1	3.3	1.3	5.8	11	5
February	41	21	57	2	2.8	2.1	4.8	10	7
March	51	30	66	13	4.0	2.0	6.0	4	6
April	63	38	80	25	3.8	2.4	6.4	(1)	2
May	74	49	87	31	4.0	1.0	6.5	----------	----------
June	82	58	95	44	3.8	0.6	4.8	----------	----------
July	87	63	99	48	4.5	1.0	6.8	----------	----------
August	84	61	94	47	5.0	1.3	8.8	----------	----------
September	79	55	90	36	3.6	1.5	7.4	----------	----------
October	68	44	84	27	3.3	1.1	5.6	(1)	1
November	54	33	69	18	3.7	1.6	7.2	1	2
December	42	24	59	6	3.5	1.5	5.8	8	6
Year	64	42	[2] 99	[3] −7	45.3	34.0	51.7	35	6

[1] Less than 0.5 day.

[2] Average annual highest temperature.

[3] Average annual lowest temperature.

TABLE 14.—*Probabilities of last freezing temperatures in spring and first in fall*

[All data from Flemington, New Jersey]

Season and probability	Dates for given probability and temperature of—				
	16° F. or lower	20° F. or lower	24° F. or lower	28° F. or lower	32° F. or lower
Spring:					
1 year in 10 later than	March 24	March 30	April 13	April 29	May 9
2 years in 10 later than	March 18	March 24	April 6	April 23	May 5
5 years in 10 later than	March 9	March 15	March 30	April 16	April 29
Fall:					
1 year in 10 earlier than	November 22	November 6	October 22	October 10	October 2
2 years in 10 earlier than	November 27	November 12	October 30	October 16	October 10
5 years in 10 earlier than	December 6	November 21	November 9	October 23	October 13

As a rule, winter temperatures are not low enough to keep the ground frozen throughout the winter. Rainfall during the winter frequently warms the soils enough to thaw them. Heavy rainfall on partly thawed soils, however, is very erosive. Hail does not occur frequently, but it can be destructive to high-value crops.

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Glossary

Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well-aerated soil is similar to that in the atmosphere, but that in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as crumbs, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alluvium. Soil material that has been deposited on land by streams.

Available water capacity. The capacity of a soil to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil.

Base saturation. The degree to which material that has base-exchange properties is saturated with exchangeable cations other than hydrogen; expressed as a percentage of the cation-exchange capacity.

Calcareous soil. A soil containing enough calcium carbonate (often with magnesium carbonate) to effervesce (fizz) visibly when treated with cold, dilute hydrochloric acid.

Channery soil. A soil that contains thin, flat fragments of sandstone, limestone, or schist, as much as 6 inches in length along the longer axis. A single piece is called a fragment.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of clay on the surface of a soil aggregate. Synonyms: Clay coat, clay skin.

Cobblestone. A rounded or partly rounded fragment of rock, 3 to 10 inches in diameter.

Colluvium. Soil material, rock fragments, or both, moved by creep, slide, or local wash and deposited at the base of steep slopes.

Conglomerate. Rock composed of gravel and rounded stones cemented together by hardened clay, lime, iron oxide, or silica.

Consistence, soil. The feel of a soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart, rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard and brittle; little affected by moistening.

Contour stripcropping. Growing crops in strips that follow the contour or are parallel to terraces or diversions. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Cover crop. A close-growing crop grown primarily to improve and to protect the soil between periods of regular crop production; or a crop grown between trees and vines in orchards and vineyards.

Diversion terrace. A ridge of earth, generally a terrace, that is built to divert runoff from its natural course and, thus, to protect areas downslope from the effects of such runoff.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation that existed during the development of the soil, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven different classes of natural soil drainage are recognized.

Excessively drained soils are commonly very porous and rapidly permeable and have a low water-holding capacity.

Somewhat excessively drained soils are also very permeable and are free of mottling throughout.

Well-drained soils are nearly free from mottling and are commonly of intermediate texture.

Moderately well drained soils commonly have a slowly permeable layer in or immediately beneath the solum. They have uniform color in the A and upper B horizons and have mottling in the lower B and C horizons.

Somewhat poorly drained soils are wet for significant periods but not all the time and commonly have mottles at a depth below 6 to 16 inches.

Poorly drained soils are wet for long periods and are light gray and generally mottled from the surface downward, although mottles may be absent or nearly so in some soils.

Very poorly drained soils are wet nearly all the time. They have a dark-gray or black surface layer and are gray or light gray, with or without mottling, in the deeper parts of the profile.

Eluviation. The movement of material from one place to another within the soil, in either true solution or colloidal suspension. Soil horizons that have lost material through eluviation are said to be eluvial; those that have received material are illuvial.

Erosion. The wearing away of the land surface by wind, running water, and other geological agents.

Flood plain. Nearly level land, consisting of stream sediment that borders a stream and is subject to flooding unless protected artificially.

Fragipan. A loamy, brittle, subsurface horizon that is very low in organic matter and clay but rich in silt or very fine sand. The layer is seemingly cemented. When dry, it is hard or very hard and has a high bulk density in comparison with the horizon or horizons above it. When moist, the fragipan tends to rupture suddenly if pressure is applied, rather than to deform slowly. The layer is generally mottled, is slowly or very slowly permeable to water, and has few or many bleached fracture planes that form polygons. Fragipans are a few inches to several feet thick. They generally occur below the B horizon, 15 to 40 inches below the surface.

Horizon, soil. A layer of soil, approximately parallel to the surface, that has distinct characteristics produced by soil-forming processes. These are the major horizons:

O horizon.—The layer of organic matter on the surface of a mineral soil. This layer consists of decaying plant residues.

A horizon.—The mineral horizon at the surface or just below an O horizon. This horizon is the one in which living organisms are most active and therefore is marked by the accumulation of mumus. The horizon may have lost one or more of the following: soluble salts, clay, and sesquioxides (iron and aluminum oxides).

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of change from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics caused (1) by accumulation of clay, sesquioxides, humus, or some combination of these; (2) by prismatic or blocky structure; (3) by redder or stronger colors than the A horizon; or (4) by some combination of these Combined A and B horizons are usually called the solum, or true soil. If a soil lacks a B horizon, the A horizon alone is the solum.

C horizon.—The weathered rock material immediately beneath the solum. In most soils this material is presumed to be like that from which the overlying horizons were formed. If the material is known to be different from that in the solum, a Roman numeral precedes the letter C.

R horizon.—Consolidated rock beneath the soil. The rock usually underlies a C horizon but may be immediately beneath an A or B horizon.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Leached soil. A soil from which most of the soluble material has been removed from the entire profile, or one in which soluble material has been removed from one part of the profile and accumulated in another part.

Mottled. Irregularly marked with spots of different colors that vary in number and size. Mottling in soils usually indicates poor aeration and lack of drainage. Descriptive terms are as follows: Abundance—*few, common,* and *many;* size—*fine, medium,* and *coarse;* and contrast—*faint, distinct,* and *prominent.* The size measurements are these: *fine,* less than 5 millimeters (about 0.2 inch) in diameter along the greatest dimension; *medium,* ranging from 5 millimeters to 15 millimeters (about 0.2 to 0.6 inch) in diameter along the greatest dimension; and *coarse,* more than 15 millimeters (about 0.6 inch) in diameter along the greatest dimension.

Ped. An individual natural soil aggregate, such as a crumb, a prism, or a block, in contrast to a clod.

Percolation. The downward movement of water through the soil.

Permeability. The quality of a soil horizon that enables water or air to move through it. Terms used to describe permeability are as follows: very slow, slow, moderately slow, moderate, moderately rapid, rapid, and very rapid.

Profile. A vertical section of the soil through all its horizons and extending into the parent material.

Reaction, soil. The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is precisely neutral in reaction. An acid soil is one that has a lower pH, and an alkaline soil, one that has a higher pH. In words, the degrees of acidity or alkalinity are expressed thus:

	pH		*pH*
Extremely acid	Below 4.5	Neutral	6.6 to 7.3
Very strongly acid	4.5 to 5.0	Mildly alkaline	7.4 to 7.8
Strongly acid	5.1 to 5.5	Moderately alkaline	7.9 to 8.4
Medium acid	5.6 to 6.0	Strongly alkaline	8.5 to 9.0
Slightly acid	6.1 to 6.5	Very strongly alkaline	9.1 and higher

Residual material. Unconsolidated, partly weathered mineral material that accumulates over disintegrating solid rock. Residual material is not soil but is frequently the material in which a soil forms.

Sand. As a soil separate, the individual rock or mineral fragments ranging from 0.05 to 2.0 millimeters in diameter. Most sand grains consist of quartz, but sand may be of any mineral composition. As a textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Silt. As a soil separate, the individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a textural class, a soil that is 80 percent or more silt and less than 12 percent clay.

Solum. The upper part of a soil profile, above the parent material, in which the processes of soil formation are active. The solum in a mature soil includes the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and other plant and animal life characteristic of the soil are largely confined to the solum.

Stripcropping. Growing crops in a systematic arrangement of strips, or bands, to serve as vegetative barriers to wind and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or clusters that are separated from adjoining aggregates and have properties unlike those of an equal mass of unaggregated primary soil particles. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular. Structureless* soils are (1) *single grain* (each grain by itself, as in dune sand) or (2) *massive* (the particles adhering together without any regular cleavage, as in many claypans and hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. Technically, the part of the soil below the solum.

Surface soil. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, about 5 to 8 inches in thickness. The plowed layer.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surplus runoff so that it may soak into the soil or flow slowly to a prepared outlet without causing harm. Terraces in fields are generally built so they can be farmed. Terraces intended mainly for drainage have a deep channel that is kept permanently in sod.

Terrace (geological). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea. Stream terraces are frequently called second bottoms, as contrasted to flood plains, and are seldom subject to overflow. Marine terraces were deposited by the sea and are generally wide.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportions of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sand clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay.* The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Tilth, soil. The condition of the soil in relation to the growth of plants, especially soil structure. Good tilth refers to the friable state and is associated with high noncapillary porosity and stable, granular structure. A soil in poor tilth is nonfriable, hard, nonaggregated, and difficult to till.

Topsoil. A presumed fertile soil or soil material, or one that responds to fertilization, ordinarily rich in organic matter, used to topdress roadbanks, lawns, and gardens.

Water table. The upper surface of ground water, or that level below which the soil is seasonally saturated with water. It does not refer to the temporary saturation level during and immediately following rains and thaws.

Water table, perched. The water table of a saturated layer of soil that is separated from an underlying saturated layer by an unsaturated layer.

Wilting point. The moisture content of a soil, on an oven-dry basis, at which plants (specifically sunflower) wilt so much that they do not recover when placed in a dark, humid atmosphere.

GUIDE TO MAPPING UNITS

For a full description of a mapping unit, read both the description of the mapping unit and that of the soil series to which the mapping unit belongs. For facts about woodland, turn to the section beginning on page 59. For facts about wildlife, turn to the section beginning on page 63. Other information is given in tables as follows:

Acreage and extent, table 1, page 7.
Predicted yields, tables 2 and 3, pages 56 and 59.

Map symbol	Mapping unit	Described on page	Capability unit		Woodland group
			Symbol	Page	Symbol
AbA	Abbottstown silt loam, 0 to 2 percent slopes	9	IIIw-70	52	3w1
AbB	Abbottstown silt loam, 2 to 6 percent slopes	9	IIIw-70	52	3w1
Ac	Alluvial land, loamy	9	IIw-79	50	2w2
Ae	Alluvial land, loamy, wet	9	IIIw-86	52	2w2
AnB	Annandale gravelly loam, 3 to 8 percent slopes	10	IIe-53	47	2o1
AnC2	Annandale gravelly loam, 8 to 15 percent slopes, eroded	10	IIIe-53	50	2o1
ApB	Annandale and Edneyville gravelly loams, 3 to 8 percent slopes	10	IIe-53	47	2o1
ApC	Annandale and Edneyville gravelly loams, 8 to 15 percent slopes	10	IIIe-53	50	2o1
AtB	Athol gravelly loam, 2 to 6 percent slopes	11	IIe-54	48	2o1
AtC2	Athol gravelly loam, 6 to 12 percent slopes, eroded	11	IIIe-54	50	2o1
AtD2	Athol gravelly loam, 12 to 18 percent slopes, eroded	11	IVe-55	52	2o1
BaB	Bedington shaly silt loam, 2 to 6 percent slopes	12	IIe-53	47	2o1
BaC2	Bedington shaly silt loam, 6 to 12 percent slopes, eroded	12	IIIe-53	50	2o1
BbB	Berks shaly loam, 2 to 6 percent slopes	12	IIe-65	49	3f1
BbC2	Berks shaly loam, 6 to 12 percent slopes, eroded	12	IIIe-65	51	3f1
BbD2	Berks shaly loam, 12 to 18 percent slopes, eroded	12	IVe-65	52	3f1
BdA	Birdsboro silt loam, 0 to 2 percent slopes	14	I-55	47	2o1
BdB	Birdsboro silt loam, 2 to 6 percent slopes	14	IIe-55	49	2o1
BdC2	Birdsboro silt loam, 6 to 12 percent slopes, eroded	14	IIIe-55	50	2o1
Bt	Bowmansville silt loam	15	VIw-86	54	1w1
BuB	Bucks silt loam, 2 to 6 percent slopes	15	IIe-55	49	2o1
BuC2	Bucks silt loam, 6 to 12 percent slopes, eroded	15	IIIe-55	50	2o1
CaA	Califon loam, 0 to 3 percent slopes	16	IIw-71	49	2w1
CaB	Califon loam, 3 to 8 percent slopes	17	IIe-71	49	2w1
CbB	Califon very stony loam, 0 to 8 percent slopes	17	VIs-75	54	2w1
CdA	Chalfont silt loam, 0 to 2 percent slopes	17	IIIw-70	52	3w1
CdB	Chalfont silt loam, 2 to 6 percent slopes	18	IIIw-70	52	3w1
CdC2	Chalfont silt loam, 6 to 12 percent slopes, eroded	18	IIIe-70	51	3w1
CeB	Chalfont very stony silt loam, 2 to 12 percent slopes	18	VIs-75	54	3w1
CfC	Chalfont-Lehigh very stony silt loams, 2 to 12 percent slopes	18	VIs-75	54	3w1
CgB	Chalfont-Quakertown silt loams, 0 to 6 percent slopes	18	IIIw-70	52	3w1
Co	Cokesbury loam	19	IVw-82	53	3w1
Cp	Cokesbury very stony loam	19	VIIs-77	55	3w1
CrA	Croton silt loam, 0 to 2 percent slopes	20	IVw-80	53	3w1
CrB	Croton silt loam, 2 to 6 percent slopes	20	IVw-80	53	3w1
CsB	Croton very stony silt loam, 0 to 6 percent slopes	20	VIIs-77	55	3w1
DuB	Duffield silt loam, 2 to 6 percent slopes	21	IIe-54	48	1o1
DuC2	Duffield silt loam, 6 to 12 percent slopes, eroded	21	IIIe-54	50	1o1
DvC2	Duffield rocky silt loam, 6 to 12 percent slopes, eroded	21	IVe-55	52	1o1
DwD2	Duffield very rocky silt loam, 12 to 18 percent slopes, eroded	21	VIs-61	54	1x1

Engineering uses of soils, tables 7, 8, and 9, pages 68 through 95.

Map symbol	Mapping unit	Described on page	Capability unit		Woodland group
			Symbol	Page	Symbol
EdB	Edneyville gravelly loam, 3 to 8 percent slopes	22	IIe-58	49	2o1
EdC2	Edneyville gravelly loam, 8 to 15 percent slopes, eroded	22	IIIe-58	51	2o1
EdD	Edneyville gravelly loam, 15 to 25 percent slopes	22	IVe-58	52	2r1
EeC	Edneyville and Parker extremely stony loams, 3 to 15 percent slopes	22	VIIs-61	55	2x1
HaB	Hazleton channery loam, 2 to 6 percent slopes	23	IIe-58	49	3f1
HaC2	Hazleton channery loam, 6 to 12 percent slopes, eroded	23	IIIe-58	51	3f1
HaD	Hazleton channery loam, 12 to 18 percent slopes	23	IVe-58	52	3f1
HcC	Hazleton very stony loam, 6 to 18 percent slopes	23	VIs-61	54	3f1
HcE	Hazleton very stony loam, 18 to 40 percent slopes	23	VIIs-61	55	3r1
KlC	Klinesville shaly loam, 4 to 12 percent slopes	24	IVe-66	53	4d1
KlD	Klinesville shaly loam, 12 to 18 percent slopes	24	VIe-66	54	4d1
LaB	Lansdale loam, 0 to 6 percent slopes	25	IIe-55	49	3o1
LaC2	Lansdale loam, 6 to 12 percent slopes, eroded	25	IIIe-55	50	3o1
LaD	Lansdale loam, 12 to 18 percent slopes	25	IVe-55	52	3o1
LbB	Lansdowne silt loam, 0 to 6 percent slopes	26	IIIw-70	52	3w1
LeB	Lawrenceville silt loam, 2 to 6 percent slopes	26	IIe-71	49	2w1
LeC2	Lawrenceville silt loam, 6 to 12 percent slopes, eroded	27	IIIe-70	51	2w1
LgB	Legore gravelly loam, 2 to 6 percent slopes	27	IIe-58	49	3o1
LgC	Legore gravelly loam, 6 to 12 percent slopes	27	IIIe-58	51	3o1
LgD	Legore gravelly loam, 12 to 18 percent slopes	27	IVe-58	52	3o1
LhB	Lehigh silt loam, 2 to 6 percent slopes	28	IIIw-70	52	3w1
LhC2	Lehigh silt loam, 6 to 12 percent slopes, eroded	28	IIIe-70	51	3w1
LhD2	Lehigh silt loam, 12 to 18 percent slopes, eroded	28	IVe-65	52	3w1
LkB	Lehigh very stony silt loam, 2 to 6 percent slopes	28	VIs-75	54	3w1
LkC	Lehigh very stony silt loam, 6 to 18 percent slopes	28	VIs-75	54	3w1
Ma	Made land	29	-----	--	---
MeB	Meckesville gravelly loam, 2 to 6 percent slopes	29	IIe-51	47	2o1
MeC2	Meckesville gravelly loam, 6 to 12 percent slopes, eroded	29	IIIe-51	50	2o1
MoB	Mount Lucas silt loam, 0 to 6 percent slopes	30	IIe-71	49	2w1
MwB	Mount Lucas-Watchung very stony silt loams, 0 to 6 percent slopes	30	VIIs-77	55	2w1
NdB	Neshaminy gravelly loam, 2 to 6 percent slopes	31	IIe-55	49	2o1
NeB	Neshaminy silt loam, 2 to 6 percent slopes	31	IIe-55	49	2o1
NeC2	Neshaminy silt loam, 6 to 12 percent slopes, eroded	31	IIIe-55	50	2o1
NhC	Neshaminy very stony silt loam, 2 to 12 percent slopes	32	VIs-61	54	2o1
NhD	Neshaminy very stony silt loam, 12 to 18 percent slopes	32	VIs-61	54	2o1
NhE	Neshaminy very stony silt loam, 18 to 40 percent slopes	32	VIIs-61	55	2r1
NkC	Neshaminy-Mount Lucas very stony silt loams, 2 to 12 percent slopes	32	VIs-61	54	2o1
NoB	Norton loam, 2 to 6 percent slopes	33	1Ie-51	47	3o1
NoC2	Norton loam, 6 to 12 percent slopes, eroded	33	IIIe-51	50	3o1
NoD2	Norton loam, 12 to 18 percent slopes, eroded	33	IVe-55	52	3o1

Map symbol	Mapping unit	Described on page	Capability unit		Woodland group
			Symbol	Page	Symbol
PaC	Parker cobbly loam, 3 to 15 percent slopes	33	IVs-60	53	3f1
PaD	Parker cobbly loam, 15 to 25 percent slopes	34	VIs-60	54	3r1
PbB	Pattenburg gravelly loam, 2 to 6 percent slopes	34	IIe-58	49	2o1
PbC2	Pattenburg gravelly loam, 6 to 12 percent slopes, eroded	34	IIIe-58	51	2o1
PbD	Pattenburg gravelly loam, 12 to 18 percent slopes	34	IVe-58	52	2o1
PbE	Pattenburg gravelly loam, 18 to 40 percent slopes	35	VIIe-60	55	2r1
PcB	Pattenburg gravelly loam, moderately wet, 2 to 6 percent slopes	35	IIe-71	49	2w1
PeB	Penn shaly silt loam, 2 to 6 percent slopes	35	IIe-65	49	3o1
PeC2	Penn shaly silt loam, 6 to 12 percent slopes, eroded	35	IIIe-65	51	3o1
PeD	Penn shaly silt loam, 12 to 18 percent slopes	36	IVe-65	52	3o1
PfB	Penn-Bucks complex, 2 to 6 percent slopes	36	IIe-65	49	3o1
PfC2	Penn-Bucks complex, 6 to 12 percent slopes, eroded	36	IIIe-65	51	3o1
Pk	Pope fine sandy loam, high bottom	36	I-57	47	1o1
QkA	Quakertown silt loam, 0 to 2 percent slopes	37	I-55	47	2o1
QkB	Quakertown silt loam, 2 to 6 percent slopes	37	IIe-55	49	2o1
QkC2	Quakertown silt loam, 6 to 12 percent slopes, eroded	37	IIIe-55	50	2o1
QkD2	Quakertown silt loam, 12 to 18 percent slopes, eroded	37	IVe-55	52	2o1
QlC2	Quakertown-Chalfont silt loams, 6 to 12 percent slopes, eroded	38	IIIe-70	51	2o1

Map symbol	Mapping unit	Described on page	Capability unit		Woodland group
			Symbol	Page	Symbol
RbA	Raritan silt loam, 0 to 2 percent slopes	38	IIw-71	49	3w1
RbB	Raritan silt loam, 2 to 6 percent slopes	39	IIe-71	49	3w1
RcB	Readington silt loam, 2 to 6 percent slopes	39	IIe-71	49	3w1
RcC2	Readington silt loam, 6 to 12 percent slopes, eroded	39	IIIe-70	51	3w1
ReA	Reaville silt loam, 0 to 2 percent slopes	40	IIIw-70	52	4w1
ReB	Reaville silt loam, 2 to 6 percent slopes	40	IIIw-70	52	4w1
ReC2	Reaville silt loam, 6 to 12 percent slopes, eroded	40	IIIe-70	51	4w1
RfA	Reaville silt loam, wet variant, 0 to 2 percent slopes	41	IVw-80	53	4w1
RfB	Reaville silt loam, wet variant, 2 to 6 percent slopes	41	IVw-80	53	4w1
RgB	Riverhead gravelly sandy loam, 2 to 6 percent slopes	42	IIe-57	49	3o1
RgC	Riverhead gravelly sandy loam, 6 to 18 percent slopes	42	IIIe-58	51	3o1
Rk	Rock land, Edneyville material	42	VIIs-67	55	2x1
RlF	Rough broken land, shale	42	VIIs-67	55	5d1
Ro	Rowland silt loam	43	Vw-78	53	2w2
SpF	Steep stony land, Parker material	43	VIIs-67	55	3f1
TuB	Turbotville loam, 2 to 6 percent slopes	44	IIe-71	49	2w1
WaB	Washington loam, 2 to 6 percent slopes	44	IIe-54	48	1o1
WaC2	Washington loam, 6 to 12 percent slopes, eroded	44	IIIe-54	50	1o1
Wc	Watchung silt loam	45	Vw-80	54	1w1

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U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
NEW JERSEY AGRICULTURAL EXPERIMENT STATION

GENERAL SOIL MAP

HUNTERDON COUNTY, NEW JERSEY

Scale 1:126,720

1 0 1 2 3 4 Miles

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SOIL ASSOCIATIONS

DOMINANTLY DEEP, LOAMY, WELL-DRAINED, GENERALLY STONY, ROCKY, AND GRAVELLY SOILS; MAINLY ON THE HIGHLANDS AND THE ADJACENT PIEDMONT PLATEAU

1. Rowland-Birdsboro-Raritan association: Deep, nearly level to gently sloping, well-drained to somewhat poorly drained, nonstony soils; on flood plains and terraces
2. Duffield-Washington association: Deep, gently sloping to moderately steep, well-drained soils; some rocky areas; on uplands
3. Parker-Edneyville-Califon association: Deep, gently sloping to steep, excessively drained to somewhat poorly drained, dominantly gravelly, cobbly, or stony soils; on uplands
4. Pattenburg association: Deep, gently sloping to very steep, well-drained, gravelly soils; on uplands
5. Washington-Berks-Athol association: Deep and moderately deep, gently sloping to moderately steep, well-drained soils; on uplands

DEEP TO SHALLOW, DOMINANTLY LOAMY AND SHALY, WELL-DRAINED TO POORLY DRAINED, GENERALLY NONSTONY SOILS OF THE PIEDMONT PLATEAU

6. Norton-Penn-Klinesville association: Deep to shallow, gently sloping to moderately steep, well-drained soils
7. Penn-Klinesville-Bucks association: Shallow to deep, gently sloping to moderately steep, well-drained soils
8. Chalfont-Croton-Quakertown association: Deep, nearly level to strongly sloping, poorly drained to well-drained soils
9. Hazleton-Quakertown-Lansdale association: Deep, gently sloping to very steep, well-drained, dominantly channery soils
10. Penn-Bucks-Reaville association: Moderately deep and deep, gently sloping to moderately steep, well-drained to somewhat poorly drained soils
11. Lehigh-Chalfont-Lawrenceville association: Deep, nearly level to moderately steep, moderately well drained and somewhat poorly drained, nonstony to very stony soils
12. Neshaminy-Mount Lucas-Legore association: Deep, nearly level to very steep, well-drained to somewhat poorly drained, mostly very stony soils

Compiled 1973

Each area outlined on this map consists of more than one kind of soil. The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts.

INDEX TO MAP SHEETS

HUNTERDON COUNTY, NEW JERSEY

Scale 1:190,080

1 0 1 2 3 4 Miles

SOIL LEGEND

The first capital letter is the initial one of the soil name. A second capital letter, A, B, C, D, E, or F, shows the dominant slope. Most symbols without a slope letter are those of nearly level soils, but some are for land types that have a considerable range of slope. A final number, 2, in a symbol shows that the soil is eroded.

SYMBOL	NAME
AbA	Abbottstown silt loam, 0 to 2 percent slopes
AbB	Abbottstown silt loam, 2 to 6 percent slopes
Ac	Alluvial land, loamy
Ae	Alluvial land, loamy, wet
AnB	Annandale gravelly loam, 3 to 8 percent slopes
AnC2	Annandale gravelly loam, 8 to 15 percent slopes, eroded
ApB	Annandale and Edneyville gravelly loams, 3 to 8 percent slopes
ApC	Annandale and Edneyville gravelly loams, 8 to 15 percent slopes
AtB	Athol gravelly loam, 2 to 6 percent slopes
AtC2	Athol gravelly loam, 6 to 12 percent slopes, eroded
AtD2	Athol gravelly loam, 12 to 18 percent slopes, eroded
BaB	Bedington shaly silt loam, 2 to 6 percent slopes
BaC2	Bedington shaly silt loam, 6 to 12 percent slopes, eroded
BbB	Berks shaly loam, 2 to 6 percent slopes
BbC2	Berks shaly loam, 6 to 12 percent slopes, eroded
BbD2	Berks shaly loam, 12 to 18 percent slopes, eroded
BdA	Birdsboro silt loam, 0 to 2 percent slopes
BdB	Birdsboro silt loam, 2 to 6 percent slopes
BdC2	Birdsboro silt loam, 6 to 12 percent slopes, eroded
Bt	Bowmansville silt loam
BuB	Bucks silt loam, 2 to 6 percent slopes
BuC2	Bucks silt loam, 6 to 12 percent slopes, eroded
CaA	Califon loam, 0 to 3 percent slopes
CaB	Califon loam, 3 to 8 percent slopes
CbB	Califon very stony loam, 0 to 8 percent slopes
CdA	Chalfont silt loam, 0 to 2 percent slopes
CdB	Chalfont silt loam, 2 to 6 percent slopes
CdC2	Chalfont silt loam, 6 to 12 percent slopes, eroded
CeB	Chalfont very stony silt loam, 2 to 12 percent slopes
CfC	Chalfont-Lehigh very stony silt loams, 2 to 12 percent slopes
CgB	Chalfont-Quakertown silt loams, 0 to 6 percent slopes
Co	Cokesbury loam
Cp	Cokesbury very stony loam
CrA	Croton silt loam, 0 to 2 percent slopes
CrB	Croton silt loam, 2 to 6 percent slopes
CsB	Croton very stony silt loam, 0 to 6 percent slopes
DuB	Duffield silt loam, 2 to 6 percent slopes
DuC2	Duffield silt loam, 6 to 12 percent slopes, eroded
DvC2	Duffield rocky silt loam, 6 to 12 percent slopes, eroded
DwD2	Duffield very rocky silt loam, 12 to 18 percent slopes, eroded
EdB	Edneyville gravelly loam, 3 to 8 percent slopes
EdC2	Edneyville gravelly loam, 8 to 15 percent slopes, eroded
EdD	Edneyville gravelly loam, 15 to 25 percent slopes
EeC	Edneyville and Parker extremely stony loams, 3 to 15 percent slopes
HaB	Hazleton channery loam, 2 to 6 percent slopes
HaC2	Hazleton channery loam, 6 to 12 percent slopes, eroded
HaD	Hazleton channery loam, 12 to 18 percent slopes
HcC	Hazleton very stony loam, 6 to 18 percent slopes
HcE	Hazleton very stony loam, 18 to 40 percent slopes
KlC	Klinesville shaly loam, 4 to 12 percent slopes
KlD	Klinesville shaly loam, 12 to 18 percent slopes
LaB	Lansdale loam, 0 to 6 percent slopes
LaC2	Lansdale loam, 6 to 12 percent slopes, eroded
LaD	Lansdale loam, 12 to 18 percent slopes
LbB	Lansdowne silt loam, 0 to 6 percent slopes
LeB	Lawrenceville silt loam, 2 to 6 percent slopes
LeC2	Lawrenceville silt loam, 6 to 12 percent slopes, eroded
LgB	Legore gravelly loam, 2 to 6 percent slopes
LgC	Legore gravelly loam, 6 to 12 percent slopes
LgD	Legore gravelly loam, 12 to 18 percent slopes
LhB	Lehigh silt loam, 2 to 6 percent slopes
LhC2	Lehigh silt loam, 6 to 12 percent slopes, eroded
LhD2	Lehigh silt loam, 12 to 18 percent slopes, eroded
LkB	Lehigh very stony silt loam, 2 to 6 percent slopes
LkC	Lehigh very stony silt loam, 6 to 18 percent slopes
Ma	Made land
MeB	Meckesville gravelly loam, 2 to 6 percent slopes
MeC2	Meckesville gravelly loam, 6 to 12 percent slopes, eroded
MoB	Mount Lucas silt loam, 0 to 6 percent slopes
MwB	Mount Lucas-Watchung very stony silt loams, 0 to 6 percent slopes
NdB	Neshaminy gravelly loam, 2 to 6 percent slopes
NeB	Neshaminy silt loam, 2 to 6 percent slopes
NeC2	Neshaminy silt loam, 6 to 12 percent slopes, eroded
NhC	Neshaminy very stony silt loam, 2 to 12 percent slopes
NhD	Neshaminy very stony silt loam, 12 to 18 percent slopes
NhE	Neshaminy very stony silt loam, 18 to 40 percent slopes
NkC	Neshaminy-Mount Lucas very stony silt loams, 2 to 12 percent slopes
NoB	Norton loam, 2 to 6 percent slopes
NoC2	Norton loam, 6 to 12 percent slopes, eroded
NoD2	Norton loam, 12 to 18 percent slopes, eroded
PaC	Parker cobbly loam, 3 to 15 percent slopes
PaD	Parker cobbly loam, 15 to 25 percent slopes
PbB	Pattenburg gravelly loam, 2 to 6 percent slopes
PbC2	Pattenburg gravelly loam, 6 to 12 percent slopes, eroded
PbD	Pattenburg gravelly loam, 12 to 18 percent slopes
PbE	Pattenburg gravelly loam, 18 to 40 percent slopes
PcB	Pattenburg gravelly loam, moderately wet, 2 to 6 percent slopes
PeB	Penn shaly silt loam, 2 to 6 percent slopes
PeC2	Penn shaly silt loam, 6 to 12 percent slopes, eroded
PeD	Penn shaly silt loam, 12 to 18 percent slopes
PfB	Penn-Bucks complex, 2 to 6 percent slopes
PfC2	Penn-Bucks complex, 6 to 12 percent slopes, eroded
Pk	Pope fine sandy loam, high bottom
QkA	Quakertown silt loam, 0 to 2 percent slopes
QkB	Quakertown silt loam, 2 to 6 percent slopes
QkC2	Quakertown silt loam, 6 to 12 percent slopes, eroded
QkD2	Quakertown silt loam, 12 to 18 percent slopes, eroded
QlC2	Quakertown-Chalfont silt loams, 6 to 12 percent slopes, eroded
RbA	Raritan silt loam, 0 to 2 percent slopes
RbB	Raritan silt loam, 2 to 6 percent slopes
RcB	Readington silt loam, 2 to 6 percent slopes
RcC2	Readington silt loam, 6 to 12 percent slopes, eroded
ReA	Reaville silt loam, 0 to 2 percent slopes
ReB	Reaville silt loam, 2 to 6 percent slopes
ReC2	Reaville silt loam, 6 to 12 percent slopes, eroded
RfA	Reaville silt loam, wet variant, 0 to 2 percent slopes
RfB	Reaville silt loam, wet variant, 2 to 6 percent slopes
RgB	Riverhead gravelly sandy loam, 2 to 6 percent slopes
RgC	Riverhead gravelly sandy loam, 6 to 18 percent slopes
Rk	Rock land, Edneyville material
RlF	Rough broken land, shale
Ro	Rowland silt loam
SpF	Steep stony land, Parker material
TuB	Turbotville loam, 2 to 6 percent slopes
WaB	Washington loam, 2 to 6 percent slopes
WaC2	Washington loam, 6 to 12 percent slopes, eroded
Wc	Watchung silt loam

CONVENTIONAL SIGNS

WORKS AND STRUCTURES

Highways and roads

- Divided
- Good motor
- Poor motor
- Trail

Highway markers

- National Interstate
- U. S.
- State and county

Railroads

- Single track
- Multiple track
- Abandoned

Bridges and crossings

- Road
- Trail
- Railroad
- Ferry (FY)
- Ford (FORD)
- Grade
- R. R. over
- R. R. under

- Buildings
- School
- Church
- Mine and quarry
- Gravel pit (G.P.)
- Power line
- Pipeline
- Cemetery
- Dams
- Levee
- Tanks
- Well, oil or gas
- Forest fire or lookout station
- Windmill
- Located object

BOUNDARIES

- National or state
- County
- Minor civil division
- Reservation
- Land grant
- Small park, cemetery, airport
- Land survey division corners

DRAINAGE

Streams, double-line

- Perennial
- Intermittent

Streams, single-line

- Perennial
- Intermittent
  - Crossable with tillage implements
  - Not crossable with tillage implements
  - Unclassified
- Canals and ditches

Lakes and ponds

- Perennial (water, w)
- Intermittent (int)

- Spring
- Marsh or swamp
- Wet spot
- Drainage end or alluvial fan

RELIEF

Escarpments

- Bedrock
- Other
- Short steep slope
- Prominent peak
- Depressions
  - Crossable with tillage implements (Large, Small)
  - Not crossable with tillage implements (Large, Small)
  - Contains water most of the time (Large, Small)

SOIL SURVEY DATA

- Soil boundary and symbol (Dx)
- Gravel
- Stoniness
  - Stony
  - Very stony
- Rock outcrops
- Chert fragments
- Clay spot
- Sand spot
- Gumbo or scabby spot
- Made land
- Severely eroded spot
- Blowout, wind erosion
- Gully

HUNTERDON COUNTY, NEW JERSEY NO. 1

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Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the New Jersey coordinate system.

1 915 000 FEET

705 000 FEET

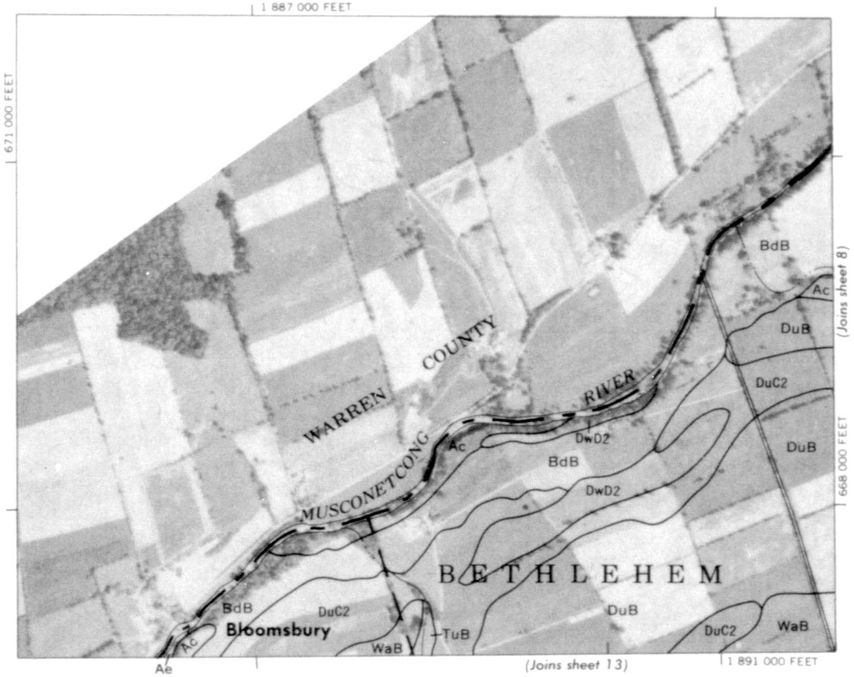
1 887 000 FEET

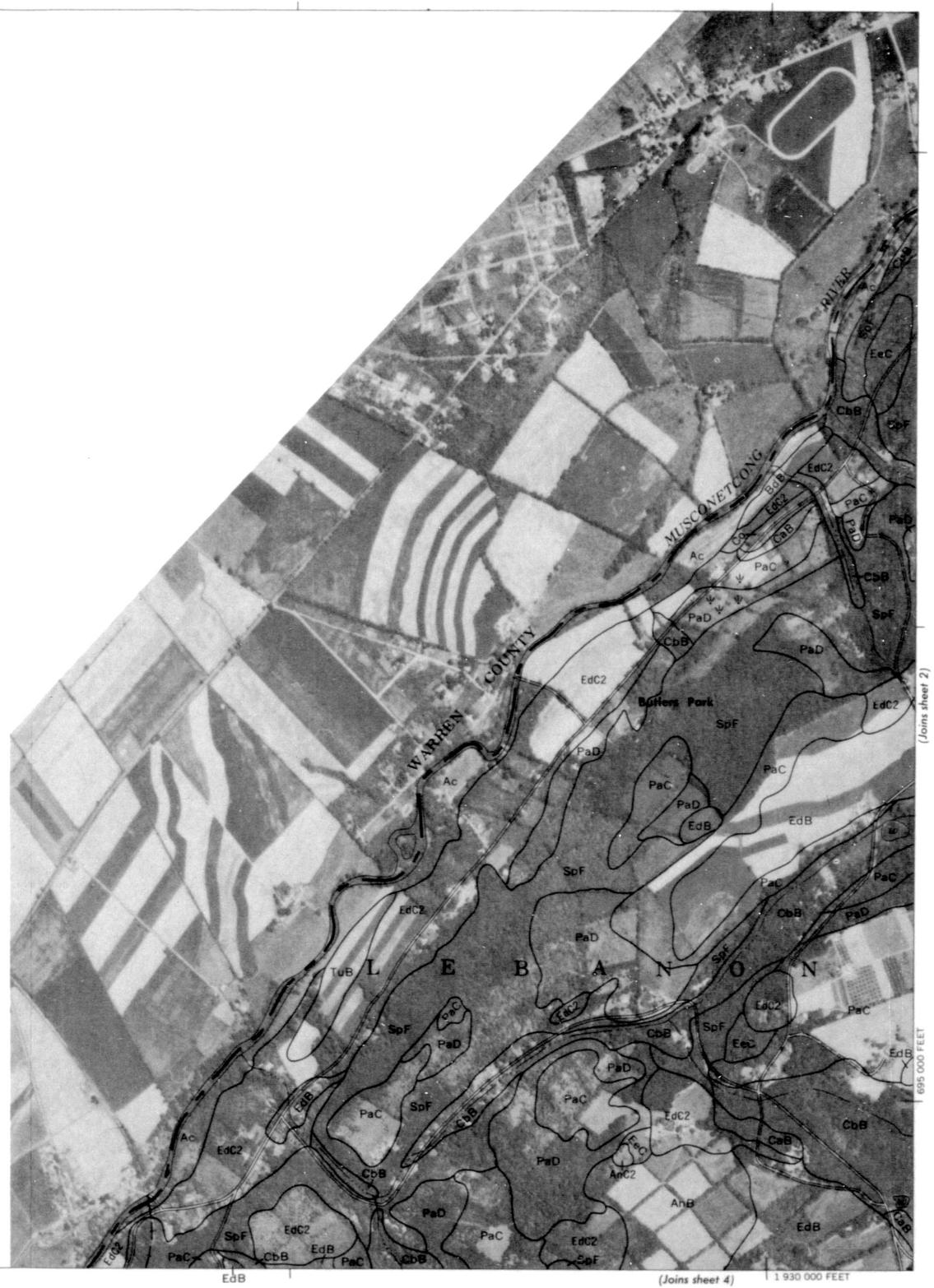
671 000 FEET

668 000 FEET

1 891 000 FEET

3 000 AND 4 000-FOOT GRID TICKS





N

1 Mile
5,000 Feet

Scale 1 :15 840

HUNTERDON COUNTY, NEW JERSEY — SHEET NUMBER 2

(2)

N

(Joins inset, sheet 3)

1 950 000 FEET

705 000 FEET

WARREN COUNTY

MUSCONETCONG RIVER

MORRIS COUNTY

Point Mtn

Anthony

Spruce Run

Little Brook

Little Brook

LEBANON

1 Mile

5000 Feet

Scale 1 :15 840

(Joins sheet 1)

(Joins sheet 3)

(Joins sheet 5)

695 000 FEET

1 935 000 FEET

Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the New Jersey coordinate system.

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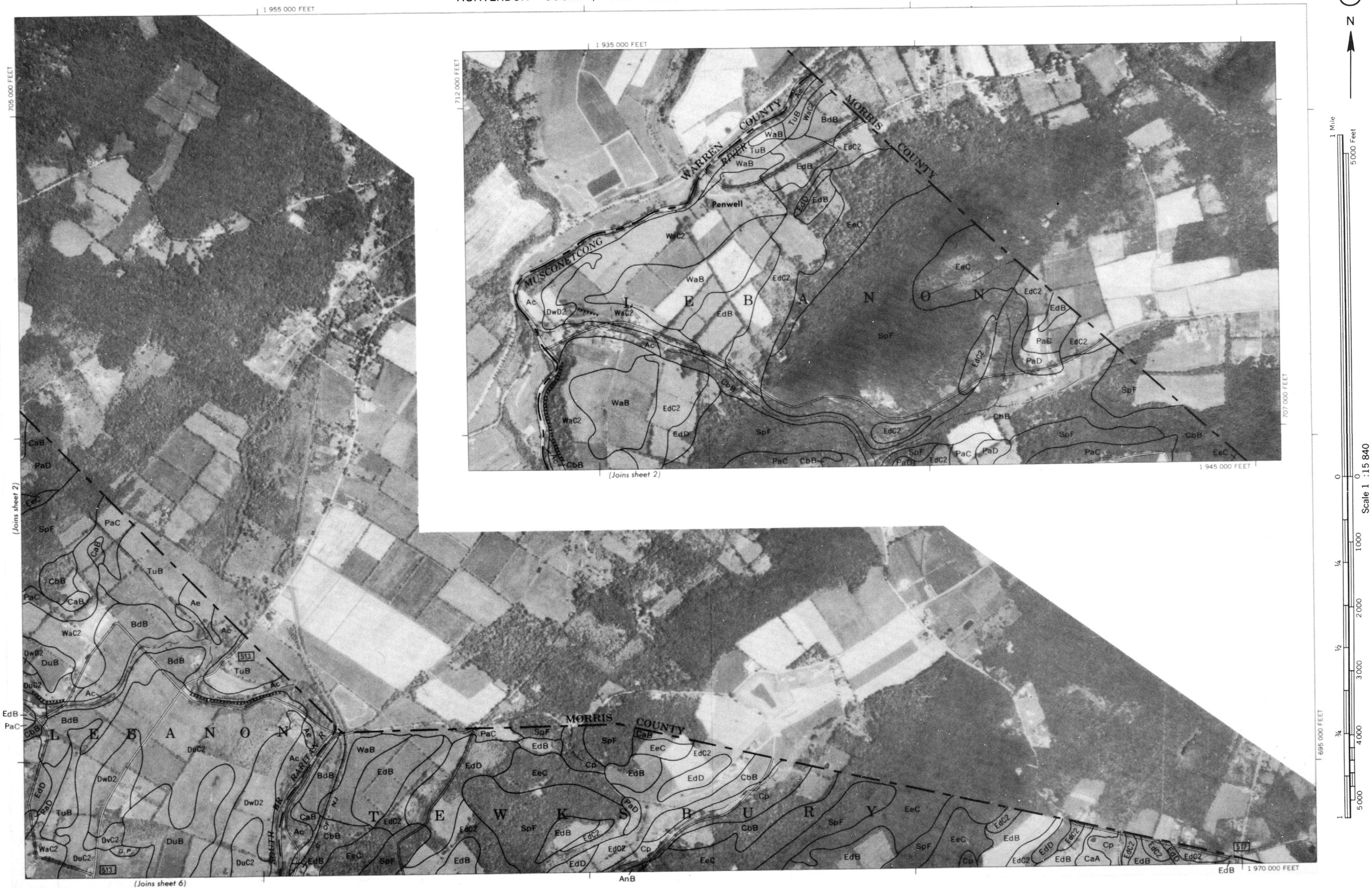
HUNTERDON COUNTY, NEW JERSEY NO. 2



HUNTERDON COUNTY, NEW JERSEY NO. 3

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Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the New Jersey coordinate system.

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HUNTERDON COUNTY, NEW JERSEY NO. 5

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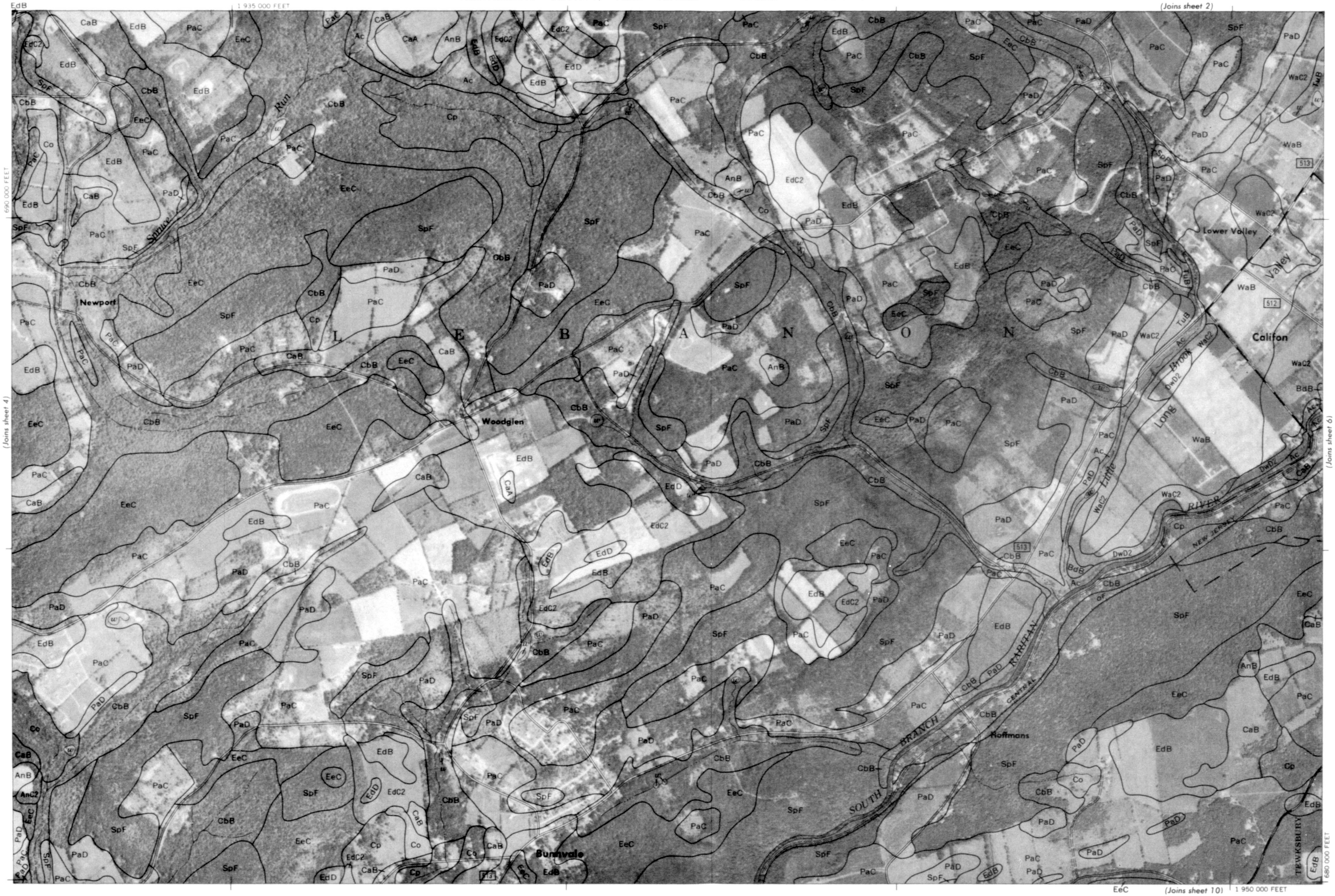


5

N

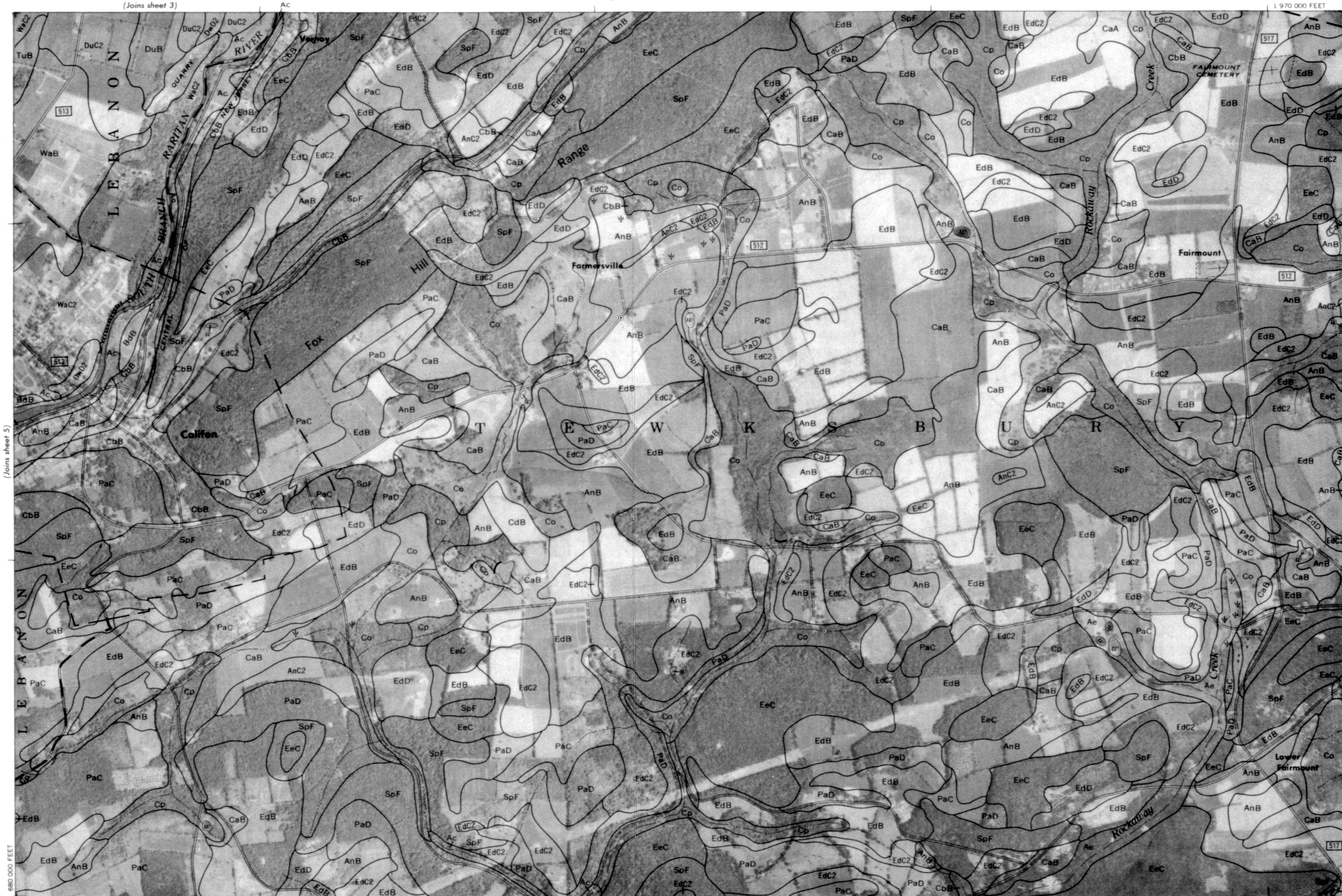
1 Mile
5,000 Feet

Scale 1 :15 840

N

(Joins sheet 3)

1 970 000 FEET



(Joins sheet 5)

(Joins sheet 7)

690 000 FEET

680 000 FEET

(Joins sheet 11)

1 955 000 FEET

1 Mile

5 000 Feet

Scale 1:15 840

0 ¼ ½ ¾ 1

0 1000 2000 3000 4000 5000

Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the New Jersey coordinate system.

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7

HUNTERDON COUNTY, NEW JERSEY NO. 7

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Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the New Jersey coordinate system.

N

1 Mile — 5000 Feet

Scale 1:15 840

N

1 Mile 5000 Feet

Scale 1:15 840

(Joins inset, sheet 4)

1 910 000 FEET

670 000 FEET

675 000 FEET

1 895 000 FEET

(Joins inset, sheet 1)

(Joins sheet 9)

(Joins sheet 14)

WARREN COUNTY

MUSCONETCONG RIVER

MUSCONETCONG

BETHLEHEM MOUNTAIN

CENTRAL NEW JERSEY

Ludlow Station

Ac BdA BdB CaB CbB Co DuB DuC2 DwD2 EdB EdC2 EdD EeC PaC PaD RbA SpF TuB WaB WaC2

Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the New Jersey coordinate system.

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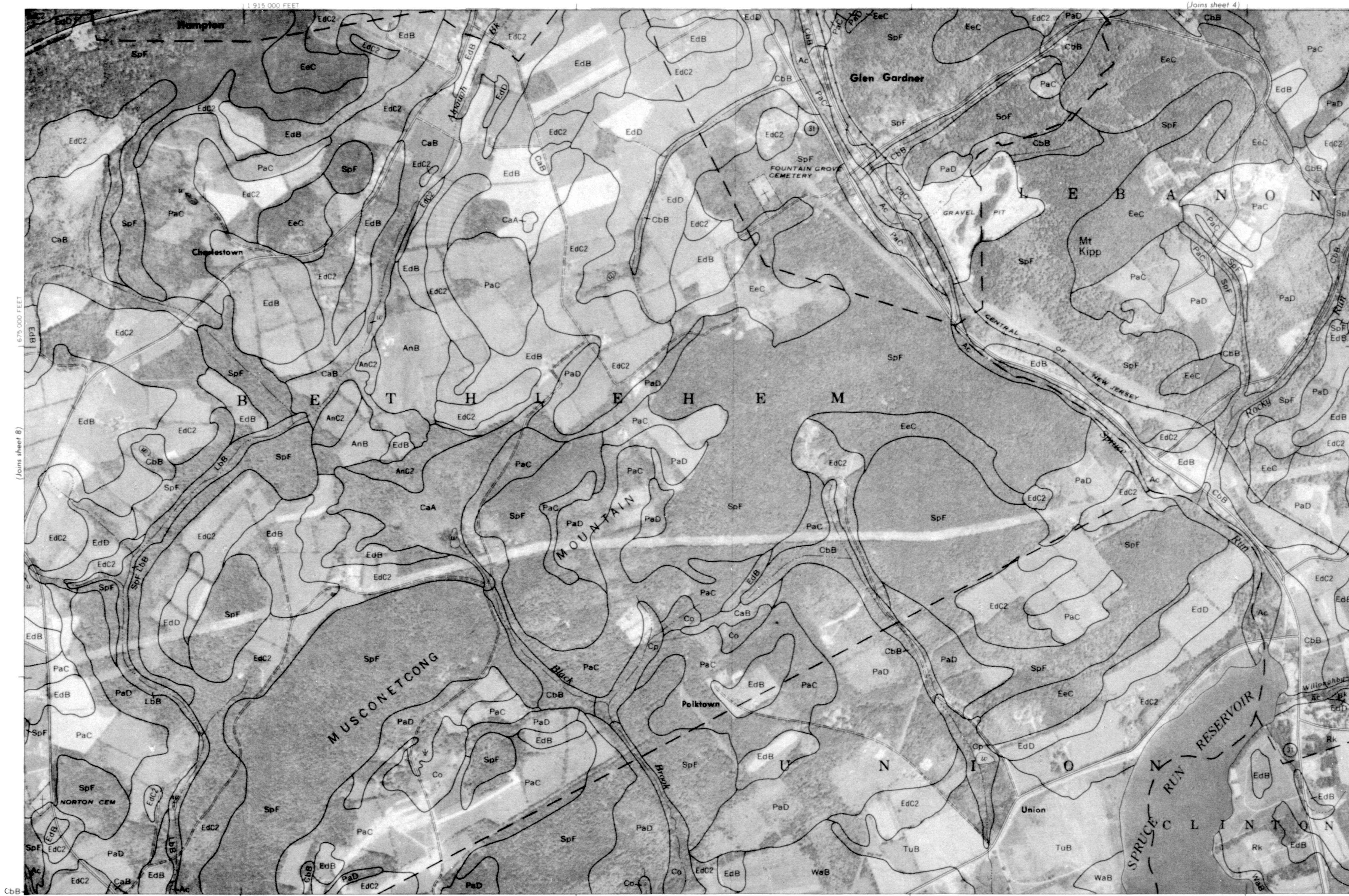
HUNTERDON COUNTY, NEW JERSEY NO. 8



9

N

1 Mile
5000 Feet

Scale 1:15 840

0 ¼ ½ ¾ 1
0 1000 2000 3000 4000 5000

HUNTERDON COUNTY, NEW JERSEY NO. 9

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Jersey Agricultural Experiment Station.
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HUNTERDON COUNTY, NEW JERSEY — SHEET NUMBER 10

(10)

N

1 Mile

5000 Feet

Scale 1 :15 840

(Joins sheet 5)

(Joins sheet 9)

(Joins sheet 11)

(Joins sheet 16)

1 950 000 FEET

675 000 FEET

670 000 FEET

1 935 000 FEET

Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the New Jersey coordinate system.

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HUNTERDON COUNTY, NEW JERSEY NO. 10

HUNTERDON COUNTY, NEW JERSEY NO. 11

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Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the New Jersey coordinate system.

1 955 000 FEET

675 000 FEET

CbB

(Joins sheet 6)

(Joins sheet 10)

(Joins sheet 12)

(Joins sheet 17)

1 970 000 FEET

670 000 FEET

11

N

Scale 1 :15 840

1 Mile

5,000 Feet

Rockaway Creek

Mountainville

Hell Mtn

Cokesbury

CLINTON

Apgars Corner

Round Top

READINGTON

TEWKSBURY

Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the New Jersey coordinate system.
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HUNTERDON COUNTY, NEW JERSEY NO. 12

HUNTERDON COUNTY, NEW JERSEY NO. 13

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Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the New Jersey coordinate system.

1 875 000 FEET

665 000 FEET

(Joins inset, sheet 1)

(Joins inset, sheet 19)

(Joins sheet 14)

(Joins sheet 20)

1 890 000 FEET

655 000 FEET

N

Scale 1 :15 840

1 Mile

5000 Feet

Bloomsbury

Swinesburg

Hakihokake Creek

MUSCONETCONG RIVER

MUSCONETCONG MOUNTAIN

WARREN COUNTY

CENTRAL NEW JERSEY LEHIGH VALLEY

BETHLEHEM

HOLLAND

ALEXANDRIA

Ac, AnB, AnC2, CaA, CaB, Co, Cp, CbB, DuB, DuC2, DwD2, EdB, EdC2, EdD, EeC, PaC, PaD, SpF, TuB, WaB, WaC2

(14)

N

1 Mile

5000 Feet

Scale 1 :15 840

0 0 1000 2000 3000 4000 5000

¼ ½ ¾ 1

(Joins sheet 8)

(Joins sheet 13)

(Joins sheet 21)

(Joins sheet 15)

1 910 000 FEET

1 895 000 FEET

665 000 FEET

655 000 FEET

West Portal

BETHLEHEM

MUSCONETCONG MOUNTAIN

ALEXANDRIA

UNION

Pattenburg

GRAVEL PIT

TUNNEL

Creek

Musconetcong

LEHIGH VALLEY

Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the New Jersey coordinate system.

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HUNTERDON COUNTY, NEW JERSEY NO. 14

HUNTERDON COUNTY, NEW JERSEY NO 15

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HUNTERDON COUNTY, NEW JERSEY — SHEET NUMBER 16

Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the New Jersey coordinate system.
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HUNTERDON COUNTY, NEW JERSEY NO. 17

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Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the New Jersey coordinate system.

17

N

1 955 000 FEET

665 000 FEET

(Joins sheet 11)

(Joins sheet 16)

(Joins sheet 18)

(Joins sheet 24)

1 970 000 FEET

655 000 FEET

T E W K S B U R Y

C L I N T O N

R E A D I N G T O N

Lebanon

Potterstown

Cushetunk Mountain

ROUND VALLEY RESERVOIR

ROUND VALLEY DAM

South Branch Rockaway Creek

CENTRAL OF NEW JERSEY

1 Mile

5000 Feet

Scale 1 :15 840

N

1 Mile

5000 Feet

Scale 1:15 840

(Joins sheet 12)

(Joins sheet 17)

(Joins sheet 25)

1 990 000 FEET

665 000 FEET

655 000 FEET

1 975 000 FEET

T E W K S B U R Y

R E A D I N G T O N

LAMINGTON RIVER

SOMERSET COUNTY

ROCKAWAY CREEK

McCrea Mills QUARRY

Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the New Jersey coordinate system.

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HUNTERDON COUNTY NEW JERSEY NO. 18

2 000 AND 3 000-FOOT GRID TICKS

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Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the New Jersey coordinate system.

N

1 Mile
5000 Feet
0

Scale 1 :15 840

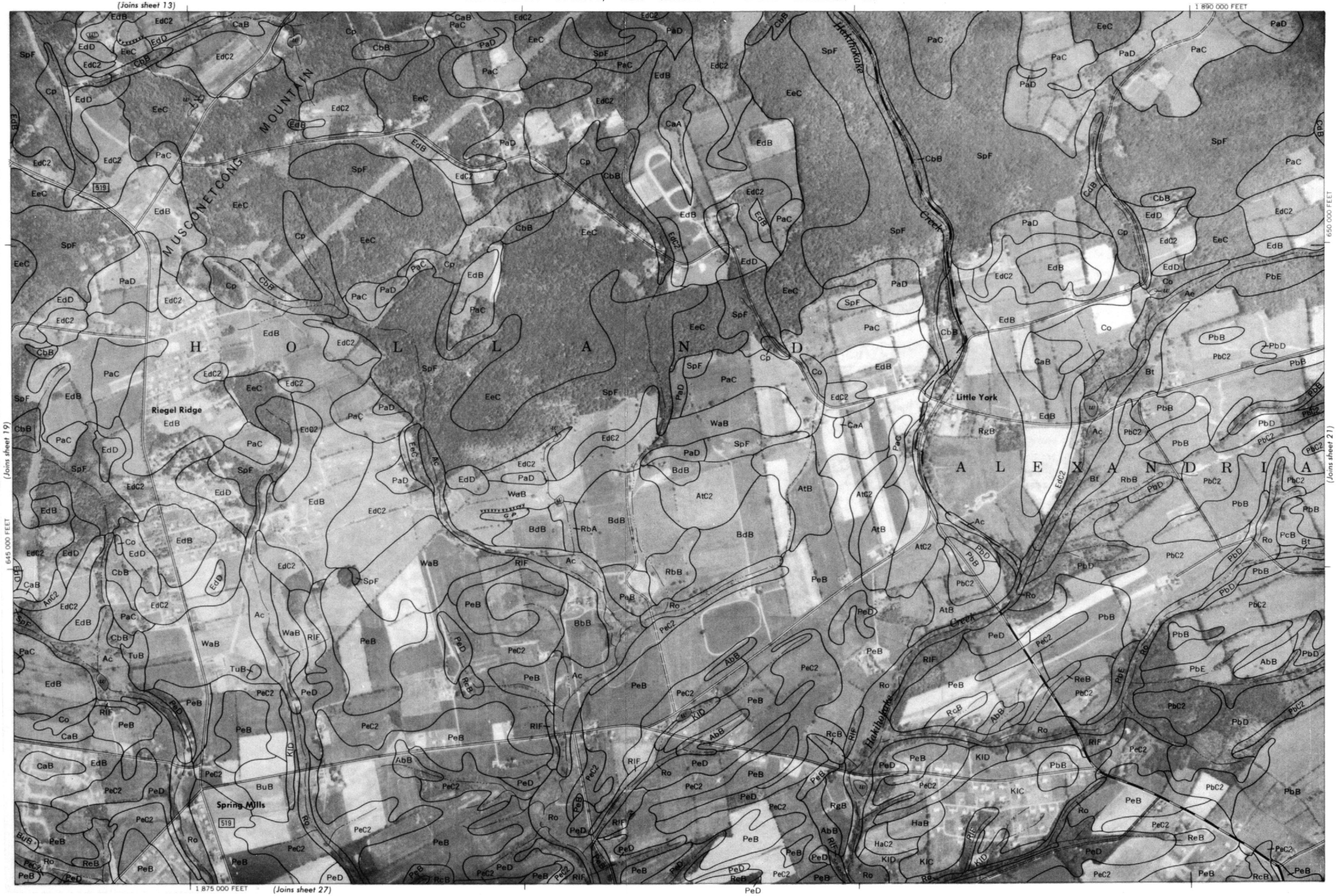
1 5 000 ¾ 4 000 ½ 3000 ¼ 2000 0 1000

HUNTERDON COUNTY, NEW JERSEY NO. 19

N

Scale 1:15 840

1 Mile — 5000 Feet



Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the New Jersey coordinate system.

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HUNTERDON COUNTY, NEW JERSEY NO. 21

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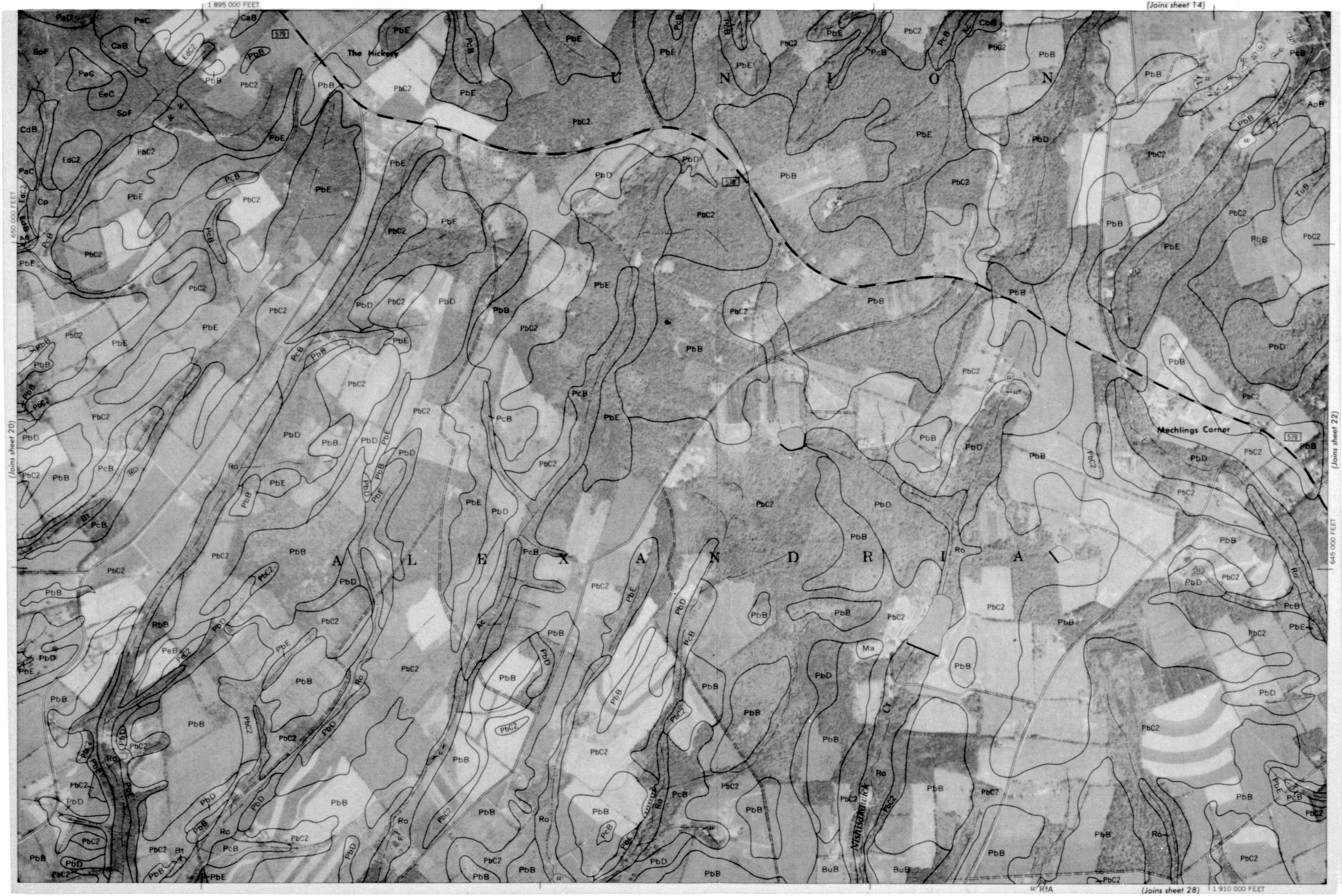
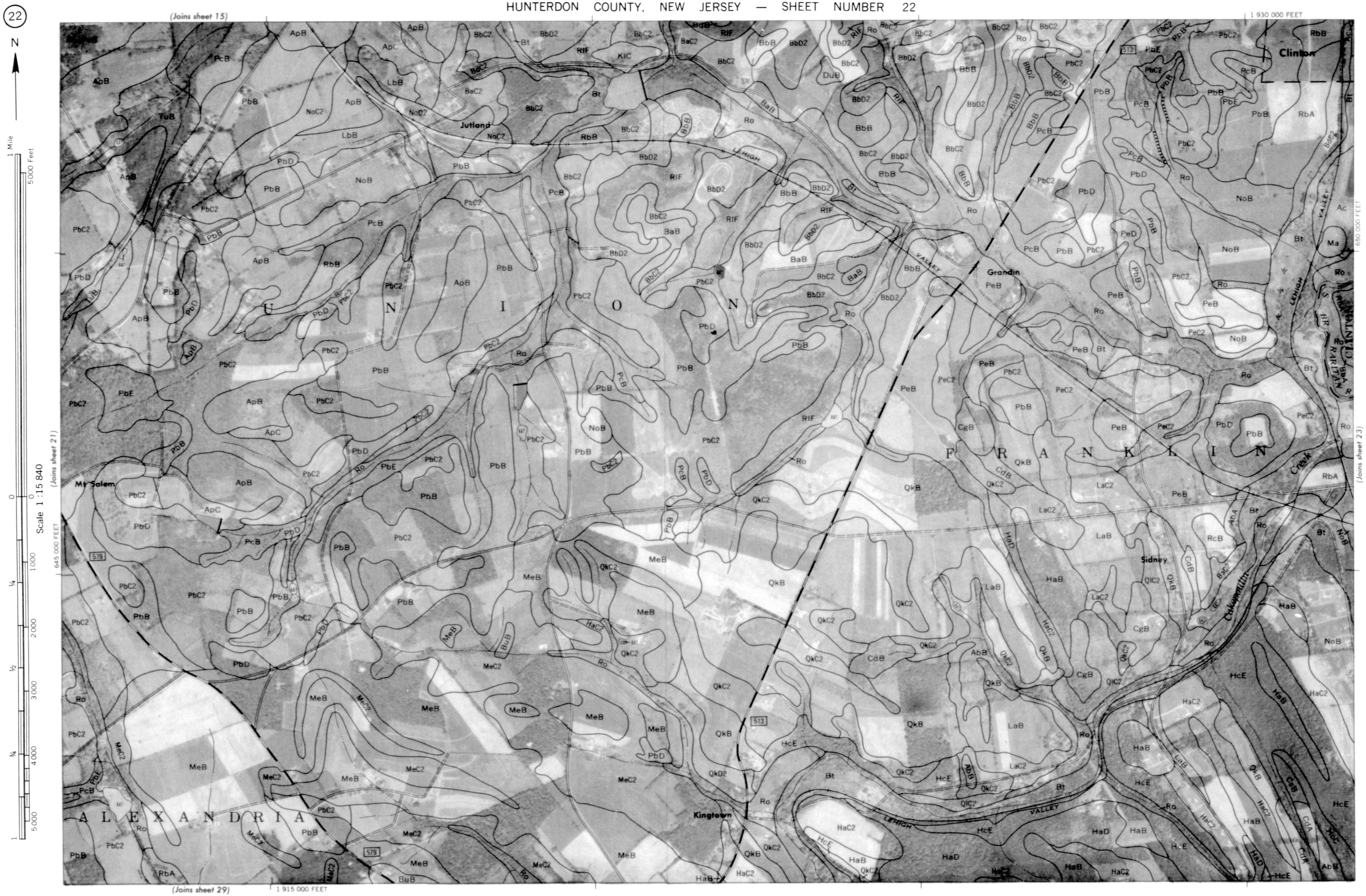


1 Mile
5000 Feet

Scale 1 :15 840



Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the New Jersey coordinate system.
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HUNTERDON COUNTY, NEW JERSEY NO. 23

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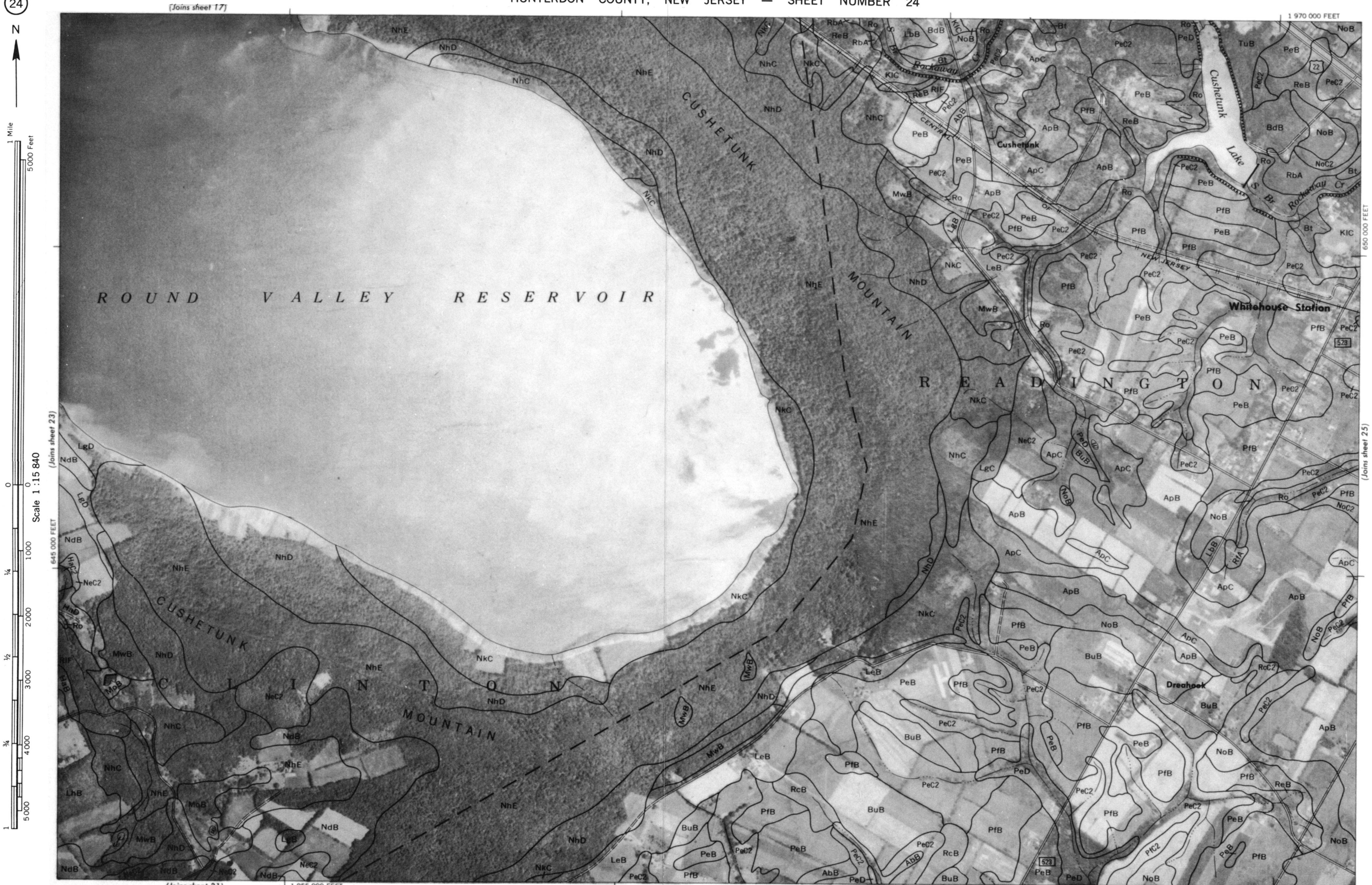
Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the New Jersey coordinate system.

23

N

1 Mile
5000 Feet

Scale 1 :15 840



Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the New Jersey coordinate system.
This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Jersey Agricultural Experiment Station.

HUNTERDON COUNTY, NEW JERSEY NO. 25

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Jersey Agricultural Experiment Station.
Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the New Jersey coordinate system.

25

N

1 Mile 5000 Feet

Scale 1 :15 840

Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the New Jersey coordinate system.
This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Jersey Agricultural Experiment Station.

HUNTERDON COUNTY, NEW JERSEY NO. 26

N

1 875 000 FEET

640 000 FEET

(Joins sheet 20)

(Joins sheet 26)

(Joins sheet 28)

(Joins sheet 33)

1 890 000 FEET

630 000 FEET

HUNTERDON COUNTY, NEW JERSEY NO 27

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Jersey Agricultural Experiment Station.
Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the New Jersey coordinate system.

Scale 1 :15 840

1 Mile

5000 Feet

HUNTERDON HOLLAND LAND

DELAWARE RIVER

BUCKS COUNTY

PENNSYLVANIA

ALEXANDRIA

Milford

Harihokake Creek

MILFORD UNION CEMETERY

519

HUNTERDON COUNTY, NEW JERSEY — SHEET NUMBER 28

Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the New Jersey coordinate system.

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Jersey Agricultural Experiment Station.

29

N

1 Mile
5000 Feet
Scale 1 :15 840
0 ¼ ½ ¾ 1
0 1000 2000 3000 4000 5000

HUNTERDON COUNTY, NEW JERSEY NO. 29

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Jersey Agricultural Experiment Station.
Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the New Jersey coordinate system.

30

HUNTERDON COUNTY, NEW JERSEY — SHEET NUMBER 30

(Joins sheet 23)

1 950 000 FEET

640 000 FEET

N

1 Mile

5000 Feet

Scale 1 :15 840

(Joins sheet 29)

(Joins sheet 31)

630 000 FEET

(Joins sheet 36)

1 935 000 FEET

Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the New Jersey coordinate system.

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Jersey Agricultural Experiment Station.

HUNTERDON COUNTY, NEW JERSEY NO. 30

N

1 955 000 FEET

640 000 FEET

(Joins sheet 24)

(Joins sheet 30)

(Joins sheet 32)

(Joins sheet 37)

1 970 000 FEET

1 630 000 FEET

C L I N T O N

R E A D I N G T O N

Stanton

Round Mountain

Pleasant Run

Pleasant Run

Highland

Byram

Scale 1 :15 840

1 Mile

5000 Feet

HUNTERDON COUNTY, NEW JERSEY NO. 31

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Jersey Agricultural Experiment Station.
Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the New Jersey coordinate system.

N

1 Mile 5000 Feet

Scale 1:15 840

0 ¼ ½ ¾ 1

0 1000 2000 3000 4000 5000

(Joins sheet 25)

(Joins sheet 31)

(Joins sheet 38)

1 990 000 FEET

640 000 FEET

630 000 FEET

1 975 000 FEET

R E A D I N G T O N

SOLBERG AIRPORT

Holland Brook

Readington

SOMERSET COUNTY

Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the New Jersey coordinate system.

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Jersey Agricultural Experiment Station.

HUNTERDON COUNTY, NEW JERSEY NO. 32

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Jersey Agricultural Experiment Station.
Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the New Jersey coordinate system.

HUNTERDON COUNTY, NEW JERSEY — SHEET NUMBER 33

(34)

N

1 Mile

5000 Feet

Scale 1 :15 840

(Joins sheet 28)

1 910 000 FEET

625 000 FEET

(Joins sheet 33)

(Joins sheet 35)

615 000 FEET

(Joins sheet 39)

1 895 000 FEET

ALEXANDRIA

KINGWOOD

Frenchtown

Baptistown

FRANKLIN

Nishisakawick Creek

Little Nishisakawick Creek

Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the New Jersey coordinate system.

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Jersey Agricultural Experiment Station.

HUNTERDON COUNTY, NEW JERSEY NO. 35

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Jersey Agricultural Experiment Station.
Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the New Jersey coordinate system.

1 915 000 FEET

625 000 FEET

(Joins sheet 29)

(Joins sheet 34)

(Joins sheet 36)

(Joins sheet 40)

1 930 000 FEET

615 000 FEET

35

N

1 Mile

5000 Feet

Scale 1 :15 840

Allens Corner

Oak Grove

Gary Corner

Lockatong Creek

Wickecheoke Creek

FRANKLIN

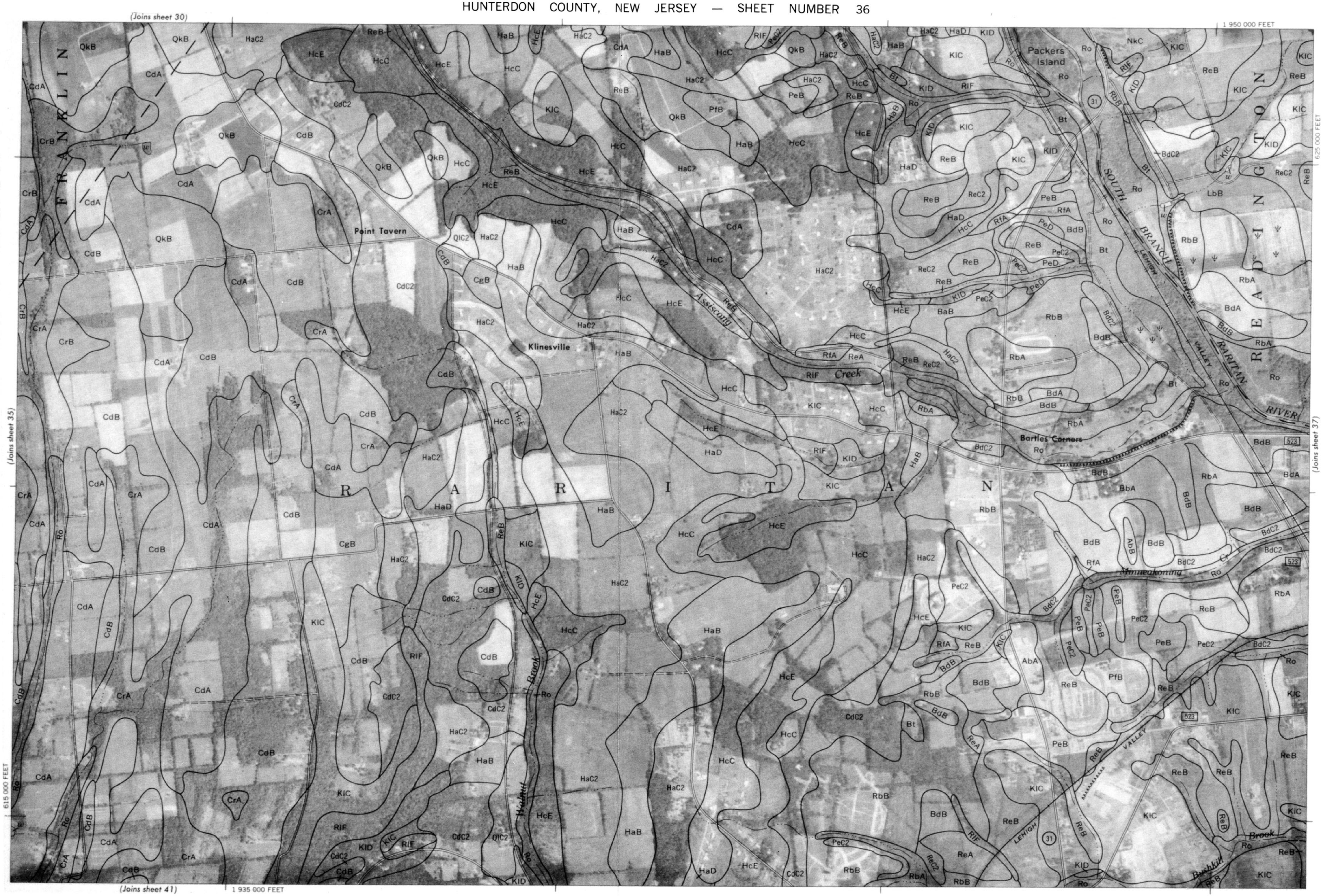
KINGWOOD

RARITAN

579

N

1 Mile
5000 Feet
Scale 1:15 840
0 ¼ ½ ¾ 1
0 1000 2000 3000 4000 5000



Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the New Jersey coordinate system.
This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Jersey Agricultural Experiment Station.

HUNTERDON COUNTY, NEW JERSEY NO. 37

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Jersey Agricultural Experiment Station.
Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the New Jersey coordinate system.

1 955 000 FEET

625 000 FEET

(Joins sheet 31)

(Joins sheet 36)

(Joins sheet 38)

615 000 FEET

(Joins sheet 42)

1 970 000 FEET

37

N

1 Mile

5000 Feet

Scale 1 :15 840

1 0 0 ¼ 1000 2000 ½ 3000 4000 ¾ 5000

Barley Sheaf

Darts Mills

Holcomb Mills

Bushkill Brook

Three Bridges

Pleasant Run

READINGTON

RARITAN

SOUTH BRANCH RARITAN RIVER

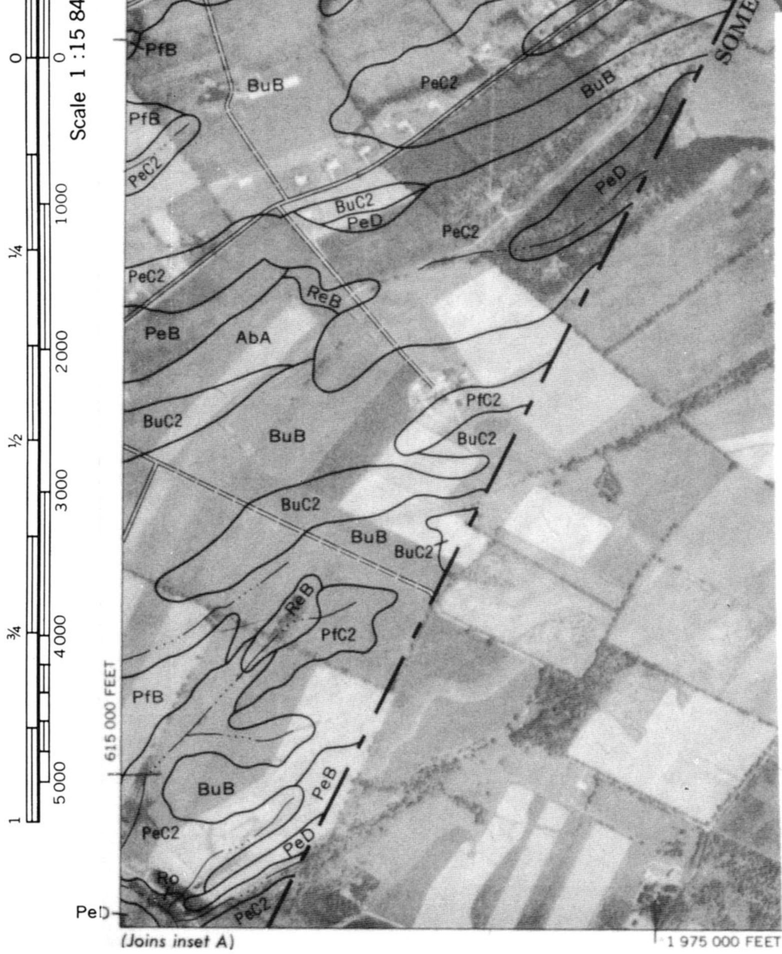
CENTRAL OF NEW JERSEY

LEHIGH VALLEY

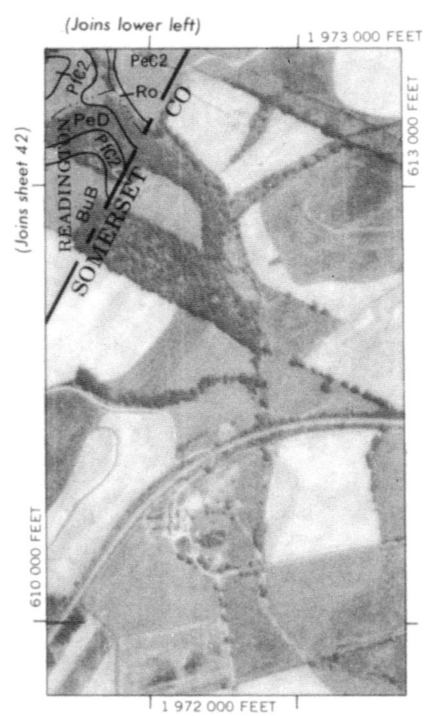
523

202

HUNTERDON COUNTY, NEW JERSEY — SHEET NUMBER 38

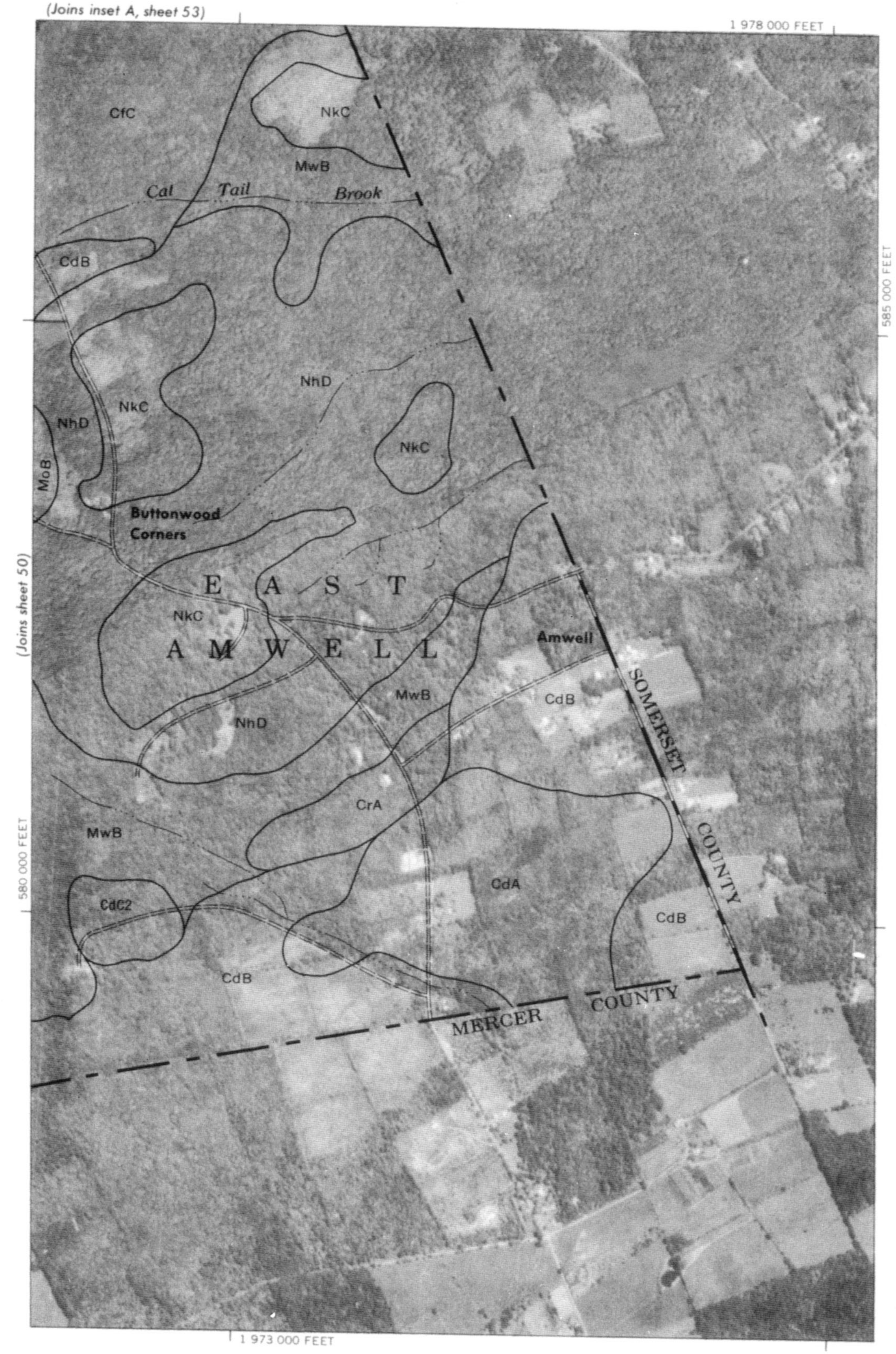



INSET A



1 000 AND 3 000-FOOT GRID TICKS

INSET B



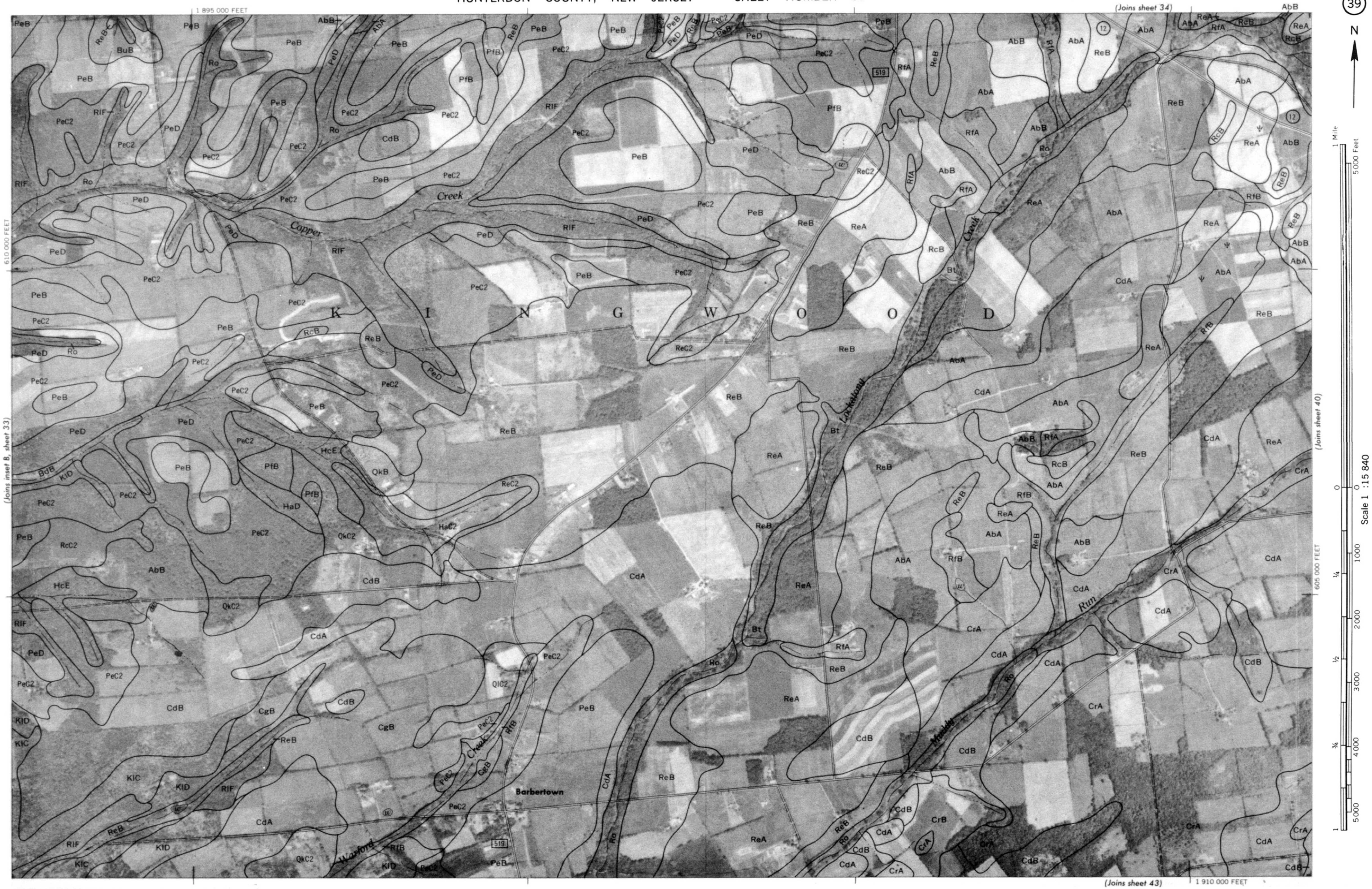
1 990 000 FEET

625 000 FEET

Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the New Jersey coordinate system.

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Jersey Agricultural Experiment Station.

HUNTERDON COUNTY, NEW JERSEY NO. 38



HUNTERDON COUNTY, NEW JERSEY NO. 39

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Jersey Agricultural Experiment Station.
Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the New Jersey coordinate system.

(Joins sheet 35)

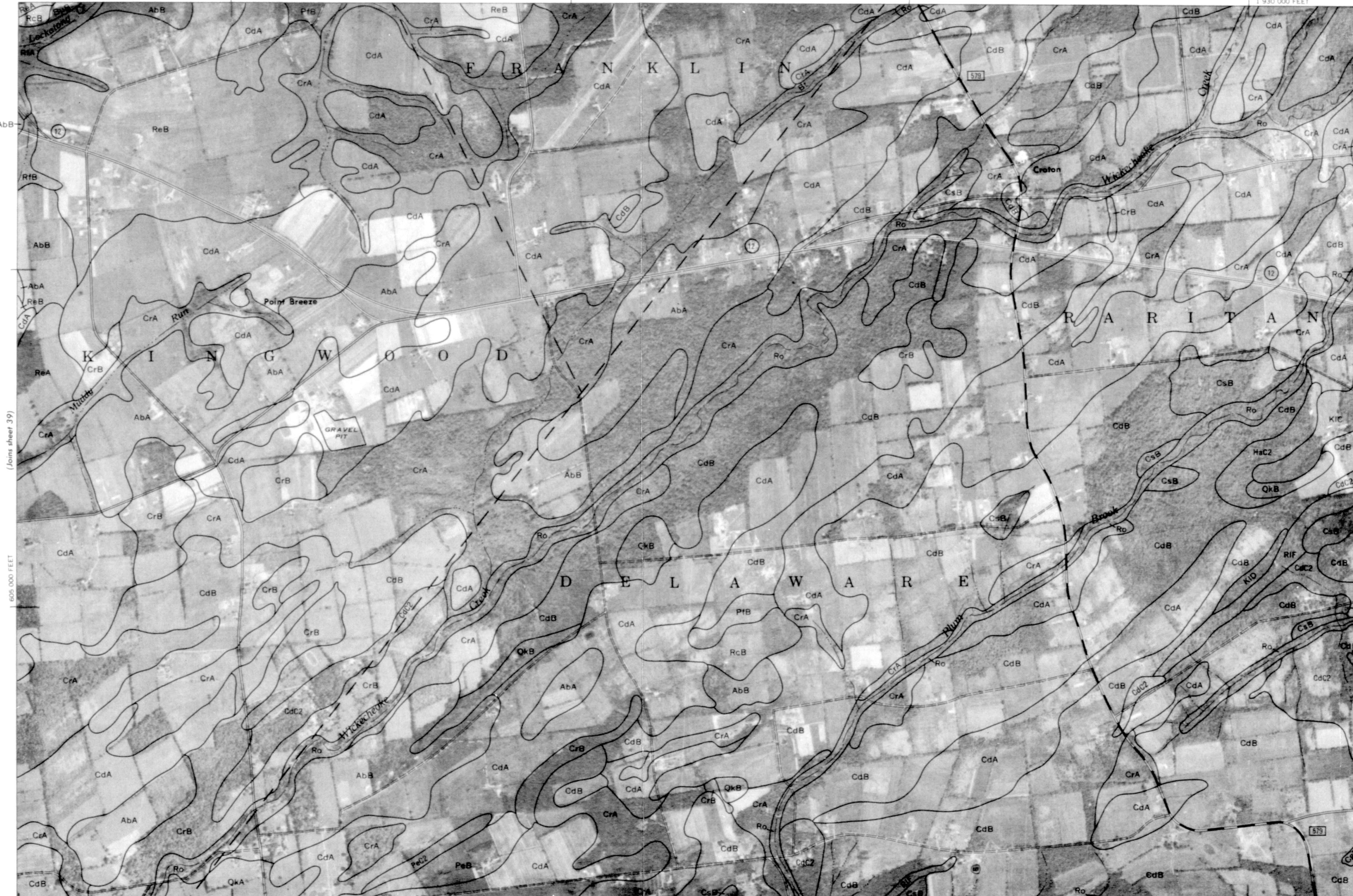
N

Scale 1:15 840

1 Mile | 0 | ¼ | ½ | ¾ | 1

5000 Feet | 0 | 1000 | 2000 | 3000 | 4000 | 5000

(Joins sheet 39)



(Joins sheet 41)

(Joins sheet 44)

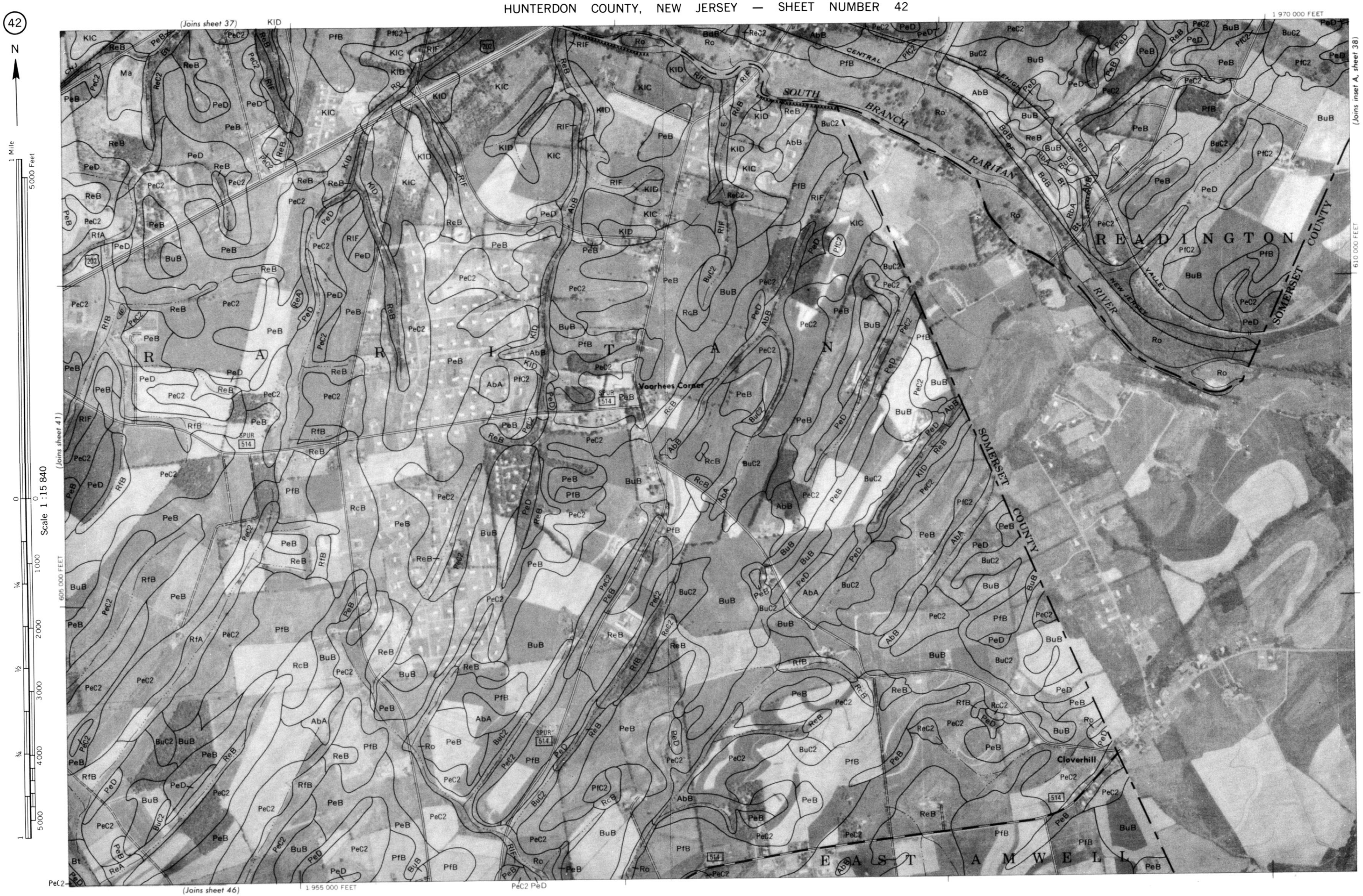
Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the New Jersey coordinate system.

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Jersey Agricultural Experiment Station.

HUNTERDON COUNTY, NEW JERSEY NO. 40

HUNTERDON COUNTY, NEW JERSEY NO. 41

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Jersey Agricultural Experiment Station.
Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the New Jersey coordinate system.



Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the New Jersey coordinate system.

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Jersey Agricultural Experiment Station.

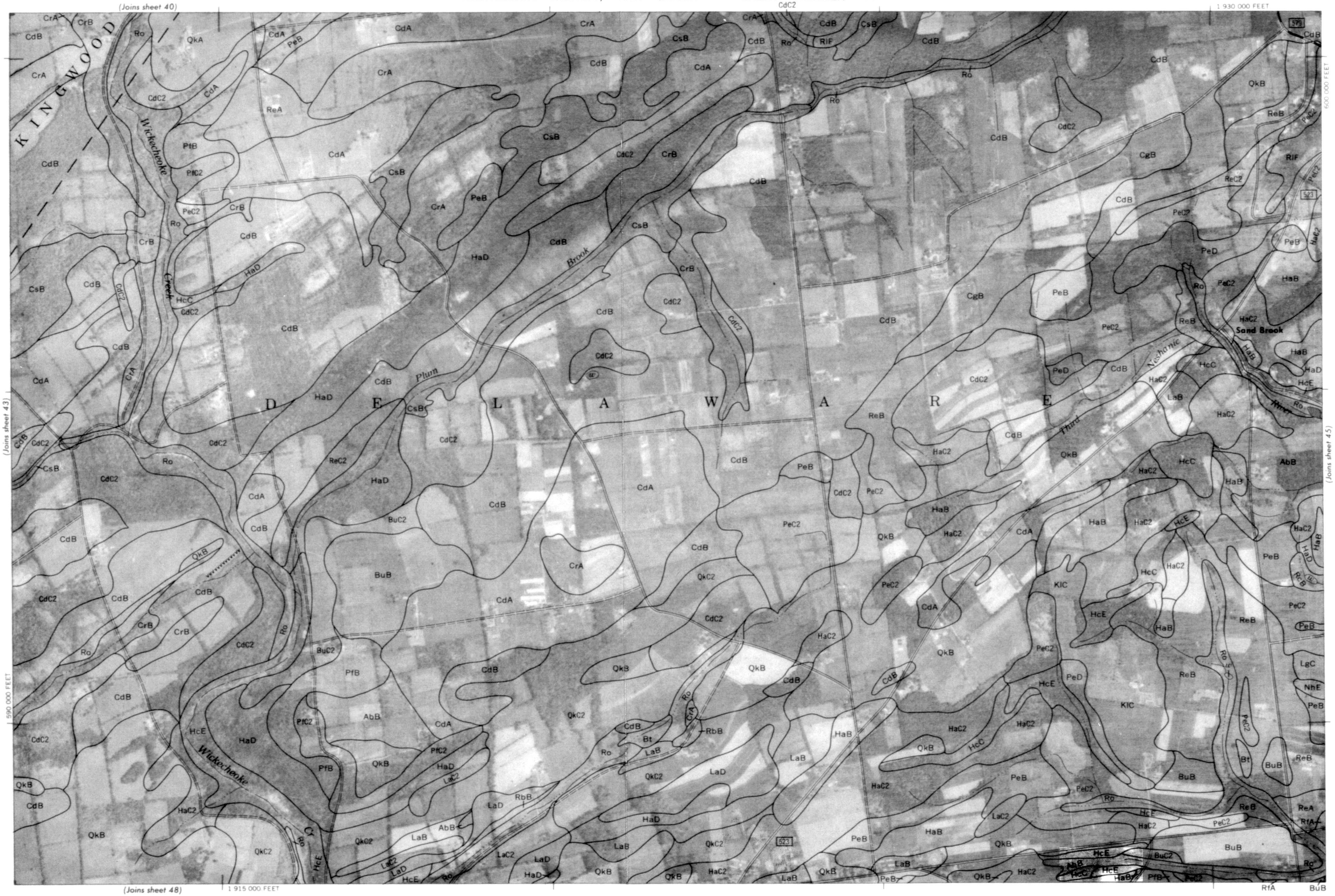
Scale 1 : 15 840

1 Mile

5000 Feet

HUNTERDON COUNTY, NEW JERSEY NO. 43

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Jersey Agricultural Experiment Station.
Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the New Jersey coordinate system.



N

1 Mile

5000 Feet

Scale 1 :15 840

0 1/4 1/2 3/4 1

0 1000 2000 3000 4000 5000

Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the New Jersey coordinate system.

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Jersey Agricultural Experiment Station.

HUNTERDON COUNTY, NEW JERSEY NO. 45

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Jersey Agricultural Experiment Station.
Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the New Jersey coordinate system.

45

N

1 Mile
5 000 Feet

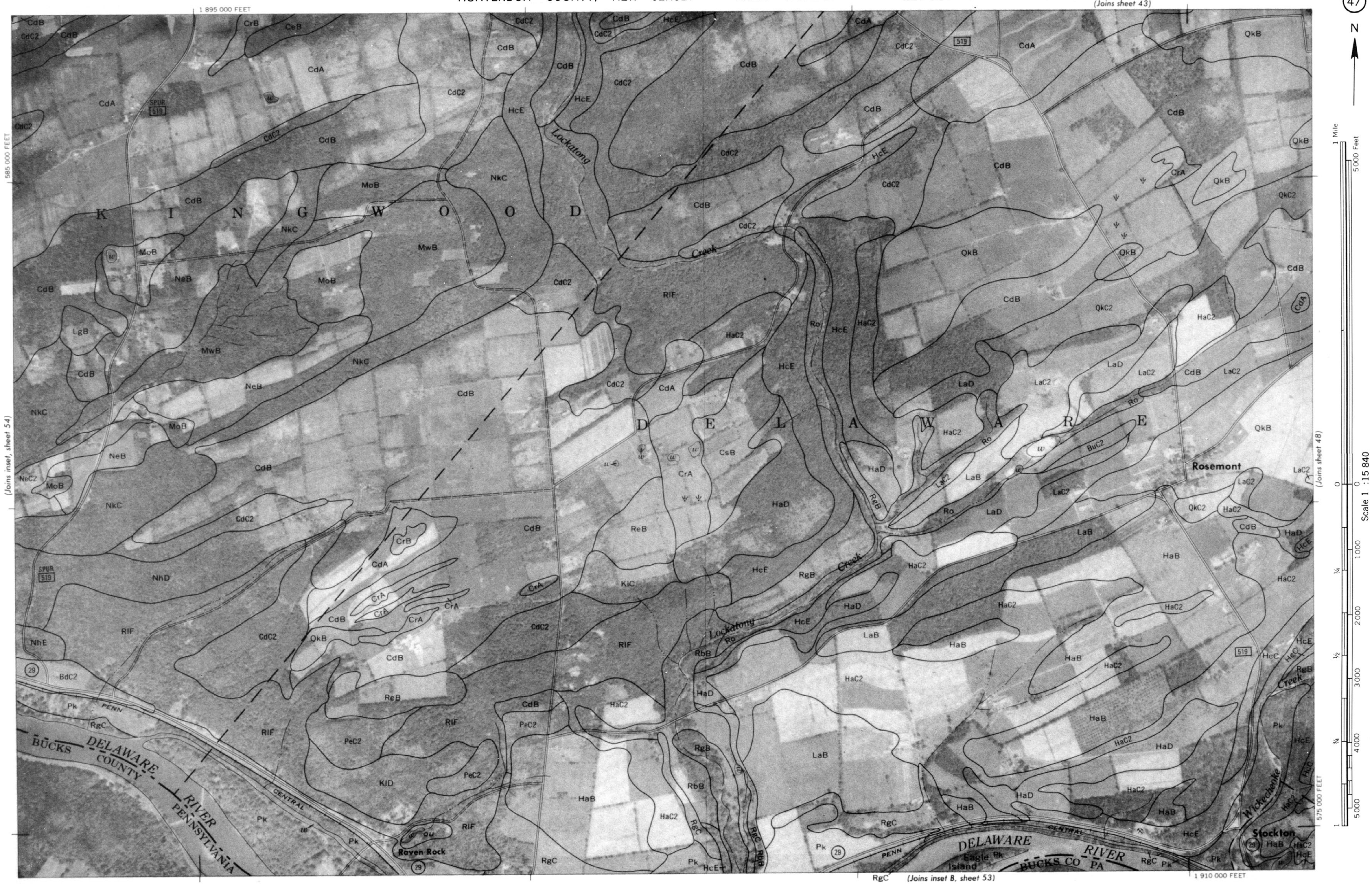
Scale 1 :15 840

HUNTERDON COUNTY, NEW JERSEY — SHEET NUMBER 46

Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the New Jersey coordinate system.

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Jersey Agricultural Experiment Station.

(47)



HUNTERDON COUNTY, NEW JERSEY NO. 47

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Jersey Agricultural Experiment Station.
Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the New Jersey coordinate system.

48

N

1 Mile

5000 Feet

Scale 1 :15 840

0 1000 2000 3000 4000 5000 FEET

¼ ½ ¾ 1

(Joins sheet 44)

(Joins sheet 47)

(Joins sheet 49)

(Joins sheet 51)

1 930 000 FEET

585 000 FEET

575 000 FEET

1 915 000 FEET

DELAWARE

Headquarters

Stockton

Dilts Corner

WEST AMWELL

Creek

Wickecheoke

Wickecheoke

PENN CENTRAL

523

Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the New Jersey coordinate system.
This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Jersey Agricultural Experiment Station.

HUNTERDON COUNTY, NEW JERSEY — SHEET NUMBER 49

1 935 000 FEET

585 000 FEET

(Joins sheet 45)

(Joins sheet 48)

(Joins sheet 50)

(Joins sheet 52)

1 950 000 FEET

575 000 FEET

N

1 Mile

5,000 Feet

Scale 1 :15 840

HUNTERDON COUNTY, NEW JERSEY NO. 49

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Jersey Agricultural Experiment Station.
Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the New Jersey coordinate system

50

N

(Joins sheet 46)

1 970 000 FEET

565 000 FEET

(Joins inset B, sheet 38)

(Joins sheet 49)

575 000 FEET

1 955 000 FEET

(Joins sheet 53)

EASTAMWELL

Vanlieu Corners

Unionville

Rileyville

MERCER COUNTY

Scale 1:15 840

1 Mile

5000 Feet

Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the New Jersey coordinate system.

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Jersey Agricultural Experiment Station.

HUNTERDON COUNTY, NEW JERSEY NO. 50

HUNTERDON COUNTY, NEW JERSEY NO. 51

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Jersey Agricultural Experiment Station.
Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the New Jersey coordinate system.

(Joins inset B, sheet 53)

(Joins sheet 48)

1 915 000 FEET

570 000 FEET

Stockton

Brookville

LAMBERTVILLE

DELAWARE - BUCKS COUNTY - PENNSYLVANIA RIVER

GRAVEL PIT

RIVERVIEW CEMETERY

Creek

Alexauken Creek

PENN CENTRAL

D E L A W A R E

W E S T A M W E L L

N

1 Mile

5000 Feet

Scale 1 :15 840

(Joins sheet 52)

565 000 FEET

(Joins sheet 54)

1 930 000 FEET

52

N

(Joins sheet 49)

1 950 000 FEET

EAST AMWELL

EAST AMWELL

WEST AMWELL

Rocktown

Mt Airy

South Hunterdon Regional High School

MERCER COUNTY

Peters Brook

565 000 FEET

570 000 FEET

(Joins sheet 51)

(Joins sheet 53)

(Joins sheet 55)

1 935 000 FEET

1 Mile

5000 Feet

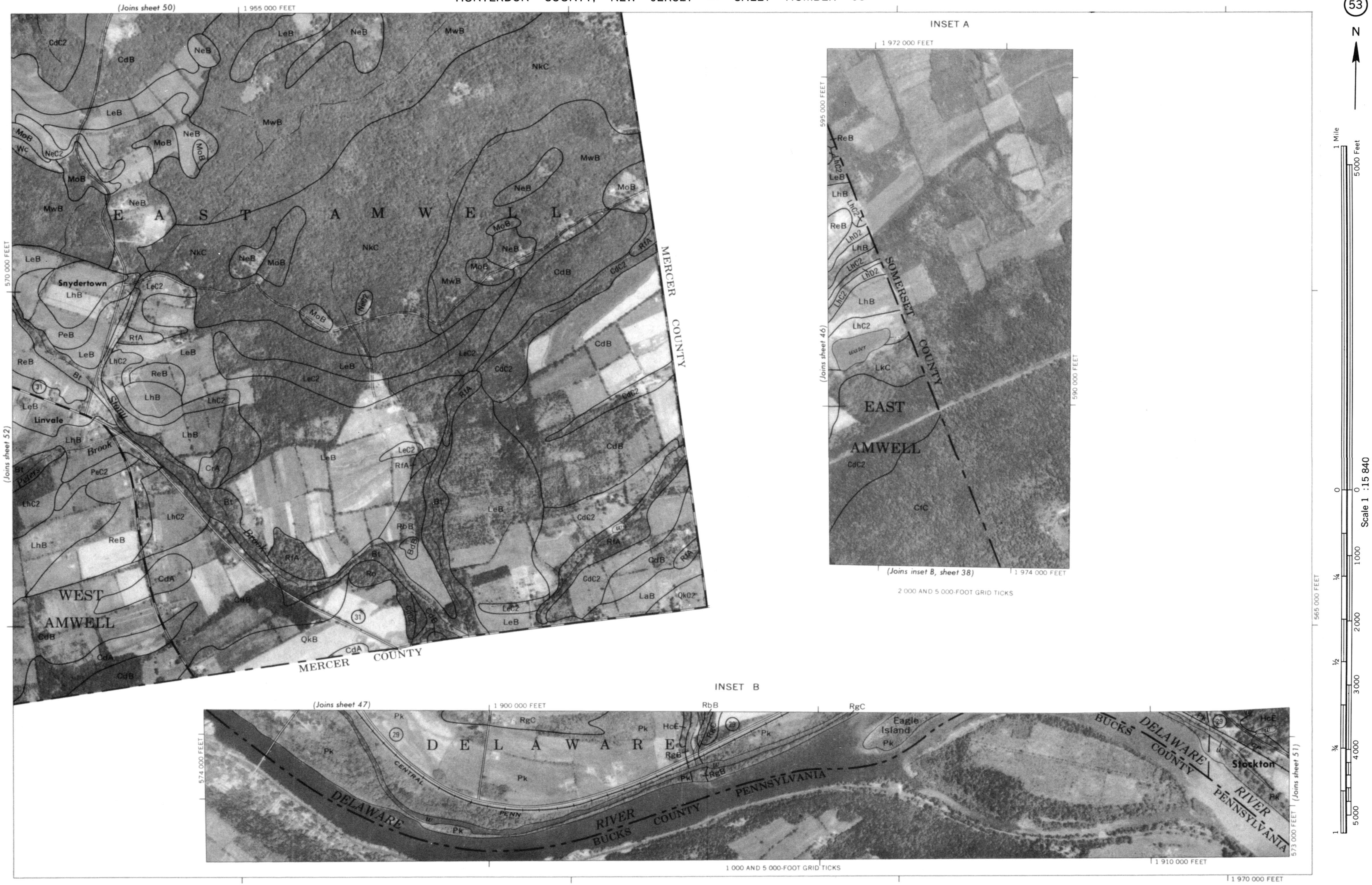
Scale 1 :15 840

0 1000 2000 3000 4000 5000

0 ¼ ½ ¾ 1

Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the New Jersey coordinate system.
This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Jersey Agricultural Experiment Station.

HUNTERDON COUNTY, NEW JERSEY NO. 52



This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Jersey Agricultural Experiment Station. Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the New Jersey coordinate system.

N

1 Mile

5,000 Feet

Scale 1 :15 840

1 892 000 FEET

(Joins inset A, sheet 38)

(Joins sheet 47)

585 000 FEET

580 000 FEET

550 000 FEET

1 890 000 FEET

1 915 000 FEET

(Joins sheet 51)

1 930 000 FEET

560 000 FEET

(Joins sheet 55)

2 000 AND 5000-FOOT GRID TICKS

Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the New Jersey coordinate system.

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Jersey Agricultural Experiment Station

HUNTERDON COUNTY, NEW JERSEY NO. 54

HUNTERDON COUNTY, NEW JERSEY NO. 55

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the New Jersey Agricultural Experiment Station.
Photobase from 1970 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the New Jersey coordinate system.